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ABSTRACT

A listing of technical reports (1968 through 1975) dealing with personnel and training research conducted by the Air Force Human Resources Laboratory (AFHRL) is presented in this bibliography. (The research has been conducted by professional personnel representing a variety of disciplines, including psychologists, operations research specialists, mathematicians, computer analysts, economists, electronic engineers, aeronautical engineers, and technical support personnel.) The table of contents provides a grouping of the research by year. Five indexes are appended: Personal Author, Civilian Corporate Author, Project, Title, Division, and Keyword. (Author/HD)

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AFHRL-TR-76-50

AIR FORCE HUMAN RESOURCES LABORATORY

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ANNOTATED BIBLIOGRAPHY OF THE AIR FORCE HUMAN RESOURCES LABORATORY TECHNICAL REPORTS – 1968 THROUGH 1975

Compiled by

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HQ AIR FORCE HUMAN RESOURCES LABORATORY
Brooks Air Force Base, Texas 78235

October 1976
Final Report for Period January 1968 – December 1975

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Technical Editing Working Group

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ASUPT	CODAP	equipment	job inventories
attitude	cost analysis	evaluation	job performance aids

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This annotated bibliography presents a listing of technical reports (1968 through 1975) dealing with personnel and training research conducted by the Air Force Human Resources Laboratory (AFHRL).

The research has been conducted by professional personnel representing a variety of disciplines, including psychologists, operations research specialists, mathematicians, computer analysts, economists, electronic engineers, aeronautical engineers, and technical support personnel.

AFHRL is charged with the planning and execution of USAF exploratory and advanced development programs for selection, motivation, training, retention, education, assignment, utilization, and career development of

Item 19(*Continued*):

job satisfaction
management
manpower
occupational analysis
personnel
readability
retention
selection
simulation
surveys
systems design
training
utilization
weapon systems

Item 20 (*Continued*):

military personnel; also the composition of the personnel force and training equipment. This Laboratory also provides technical and management assistance to support studies, analyses, development planning activities, acquisition, test evaluation, modification, and operation of aerospace systems and related equipment.

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ANNOTATED BIBLIOGRAPHY OF THE AIR FORCE HUMAN RESOURCES LABORATORY TECHNICAL REPORTS – 1968 THROUGH 1975

INTRODUCTION

The Air Force Human Resources Laboratory (AFHRL), Brooks AFB, Texas, was established in 1968 as an Air Force Systems Command (AFSC) laboratory. (During the early part of 1968 it was part of the Aerospace Medical Division.)

This Laboratory is charged with the planning and execution of USAF exploratory and advanced development programs for selection, motivation, training, retention, education, assignment, utilization, and career development of military personnel; also the composition of the personnel force and training equipment. This Laboratory also provides technical and management assistance to support studies, analyses, development planning activities, acquisition, test evaluation, modification, and operation of aerospace systems and related equipment.

At the end of 1975, AFHRL consisted of a headquarters at Brooks AFB and six divisions geographically dispersed throughout the United States as follows:

1. Advanced Systems Division, Wright-Patterson AFB, Ohio. (This was the Training Research Division until June 1970.)

2. Computational Sciences Division, Lackland AFB, Texas. (This was part of the Personnel Research Division until August 1973.)

3. Flying Training Division, Williams AFB, Arizona. (This division was established May 1969.)

4. Occupational and Manpower Research Division, Lackland AFB, Texas. (This was part of the Personnel Research Division until August 1973, when it became the Occupational Research Division. In November 1974, this division incorporated part of the Manpower and Personnel Systems Division, which was deactivated, and was renamed the Occupational and Manpower Research Division.)

5. Personnel Research Division, Lackland AFB, Texas. (For a short time during 1970 and 1971, this division was called the Personnel Division.)

6. Technical Training Division, Lowry AFB, Colorado. (This division was established May 1969.)

During this period, other organizational changes are evidenced in this bibliography: (a) The Professional Education Division with offices at Brooks AFB, Texas; the Air Force Academy, Colorado; and Maxwell AFB, Alabama, was deactivated in June 1972. (b) The Manpower Development Division, Alexandria, Virginia, became part of the new Manpower and Personnel Systems Division, Lackland AFB, Texas, in August 1973, and was later deactivated to become part of the Occupational and Manpower Research Division as stated earlier.

Abstract entries list the division name at the time of report publication.

During 1967–1970, seven volumes on learner-centered instruction were published jointly by AFHRL and Aerospace Medical Research Laboratories (AMRL). Volumes I, II, and III are AMRL TRs 67-208, 68-51, and 68-116, respectively. Volumes IV, V, VI, and VII are AFHRL TRs 68-14, 69-2, 69-15, and 70-1, respectively.

This bibliography covers abstracts of 540 technical reports published through 1975.

The abstracts appear in technical report number sequence. Entries following the author and title heading give information identifying the report and indicate where it is available:

Project number: Research areas identified by these numbers are given in the PROJECT index. The Air Force contract number and the name of the contracting organization are entered for contract-produced reports.

DDC accession number indicates availability to Government offices and registered contractors from the Defense Documentation Center; this number should be used when requesting reports from DDC.

NTIS appears only if the report has been deposited with the National Technical Information Service, Springfield, Virginia, 22151, for sale to the general public.

This bibliography contains six indexes: PERSONAL AUTHOR, CIVILIAN CORPORATE AUTHOR, PROJECT, TITLE, DIVISION, and KEY WORD. Reports are identified in the indexes by the serial number appearing in the left margin of the abstract entries. This report does not contain classified or For Official Use Only technical reports.

AIR FORCE HUMAN RESOURCES LABORATORY (AFHRL) SERIES

July 1968 – December 1975

1 **Elliott, T.K., & Joyce, R.P. An experimental comparison of procedural and conventional electronic troubleshooting. AFHRL-TR-68-1, AD-681 510. Wright-Patterson AFB, OH: Training Research Division, November 1968. Project 1710, Contract F33615-67-C-1776, Applied Science Associates, Inc. NTIS.** Two groups of subjects solved the same set of 13 troubleshooting and repair problems in seven solid-state circuit modules which contained up to five stages each. Both groups used the same hand tools and test equipment. One group was composed of 41 Air Force 5- and 7-level technicians who normally maintain such equipment as part of their jobs. The technicians used the same troubleshooting techniques they ordinarily used on their jobs, and they were provided with a conventional technical order-like performance aid to support the task. The other group was composed of 20 high school students with no prior training or experience in electronics. Their training for this study consisted of a special 12-hour course (compared to several months for the technicians) and they used a specially developed performance aid which told them which check to make, based on the outcome of previous checks. In terms of the speed with which they were able to effect repairs on the modules, there were no substantial differences between the two groups. But the difference in training time and, therefore, cost of training between the two groups is so great as to suggest the possibility that job-relevant training and proceduralization of the task can introduce substantial savings, even after the cost of developing the special performance aids required by proceduralized troubleshooting is subtracted. The findings of the series of six studies of which this study was one are also summarized. (128 pp.)

2 **Holden, L.D. Development of visual simulation modifications for field evaluation. AFHRL-TR-68-3, AD-681 175. Wright-Patterson AFB, OH: Training Research Division, October 1968. Project 6114, Contract F33615-67-C-1965, Systems Research Laboratories, Inc. NTIS.** The purposes of this effort was to modify an SMK-23 Visual Simulator Attachment for use in determining the training value of various configurations of visual simulation systems. This report documents the required modifications to the SMK-23 television system to convert it from projected field sequential color operation to projected high resolution monochrome. Also documented is the replacement of the projection system with a high resolution monochrome lens-monitor system. A comparative evaluation of the original SMK-23 television system and the two modified display systems is presented. The lens-monitor type display is a vast improvement over the other systems. This display provides the advantages of high resolution, more contrast and brightness, a virtual image, as well as more reliability and lower cost. Finally, an improved SMK-23 model lighting system is described which enhances the television display contrast and yet uses only 20% of the original light power. (102 pp.)

3 **Semple, C.A., & Majesty, M.S. Operational tasks oriented flying training program for pilot training: the systems approach. AFHRL-TR-68-4, AD-673 372. Wright-Patterson AFB, OH: Training Research Division, January 1969. Project 1710, Contract F33615-68-C-1533, Bunker-Ramo Corporation, NTIS.** The purpose of the study was to take a fresh and independent look at flying training requirements unhampered by the current training program and the traditional approach. The report presents a systems methodology for determining knowledges and skills common to piloting tasks required by differing aircraft-missions for the purpose of structuring a data base from which an operational tasks oriented flying training program could be developed. The general approach was to identify and classify the specific tasks performed by USAF pilots and the level of proficiency required on each task for successful performance in current and projected assignments in operational units using present and projected aircraft. The study was planned to encompass cross-system analysis and the integration of pilot tasks data into the Air Force Human Resources Laboratory's (AFHRL) computer based data bank. Therefore, inquiries across and within aircraft systems pertaining to

piloting tasks, training requirements, and performance standards would be possible. Criteria for establishing common mission segments, tasks and cockpit subsystem hardware are presented. The technique for analyzing common tasks is presented in relation to assumptions regarding the type of training programs to which the data could apply. Rules for describing task activities and preparing the data for insertion into the computer based data bank are given. (44 pp.)

4 **Purifoy, G.R., Jr. Instructional methodology and experimental design for evaluating audio/video support to undergraduate pilot training. AFHRL-TR-68-5, AD-680 408. Wright-Patterson AFB, OH: Training Research Division, October 1968. Project 686F, Contract F33615-68-C-1048, American Institutes for Research. NTIS.** This report presents a detailed description of the methods by which airborne video recording will be utilized in the training of Air Force pilots, and presents plans for an assessment of its effectiveness. Audio/video equipment configurations and limitation are discussed as they apply to training operations in the T-37 and T-38 aircraft, and training methodology is described which has been formulated to permit the integration of video recording and teaching techniques into the Air Force Undergraduate Pilot Training program. Plans for an eight-month experimental evaluation of the effects of these techniques are detailed, including schedules, operating practices, student selection procedures, instructor training plans, data gathering processes and materials, and analysis guidelines. (86 pp.)

5 **Spencer, G.R. Research and development of high-brightness projection kinescopes. AFHRL-TR-68-6, AD-689 749. Wright-Patterson AFB, OH: Training Research Division, May 1969. Project 6114, Contract AF33(615)-1753, Raytheon Company. NTIS.** In a preliminary Phase of study and experimentation, a number of luminescent materials were investigated to provide a basis of selection of a phosphor for subsequent application in a high-brightness projection cathode-ray tube. Utilizing the principle of forced-cooling of the phosphor substrate to limit the thermal contribution to brightness saturation, a projection tube was developed having an angled neck, an ion-trap tetrode gun, and a clear glass optional window situated parallel to a liquid-cooled metal base-plate on which the phosphor screen was deposited. Three models of this tube were constructed. Measurements showed the tube capable of providing an acceptable quality projection television display of 9 ft Lamberts brightness in a 3′ x 4′ image, using an f/1.2 lens and viewing screen having a gain of 2. Tube life was found to be in excess of 500 hours of operation with continuous, intense, full-raster bombardment, resulting in less than 50% reduction in luminous efficiency. (52 pp.)

6 **Askren, W.B., & Newton, R.R. Review and analysis of personnel subsystem test and evaluation literature. AFHRL-TR-68-7, AD-859 300. Wright-Patterson AFB, OH: Training Research Division, January 1969. Project 1710. NTIS.** This report reviews and analyzes 95 documents related to Personnel Subsystem Test and Evaluation. The reports are divided into two groups: (1) system tests and (2) related research material. Each report is abstracted and then analyzed further in terms of 11 categories: a. Scope and Relation to Personnel Subsystem Elements; b. Test Objectives; c. Data Requirements and Test Criteria; d. Data Collection Methodology; e. Support Requirements; f. Reducing and Analyzing Data; g. Significant Test Results; h. Communicating and Using Test Results; i. Factors in Planning a Test Program; j. Factors in Conducting a Test Program; k. Other Problems. (388 pp.)

7 **Soxman, E.J., Sharp, W.N., Orloff, K.L., & Tsiang, E.Y. Development of thin film CdS photoresistive arrays for an analog multiplier. AFHRL-TR-68-8, AD-686 777. Wright-Patterson AFB, OH: Training Research Division, February 1969. Project 6114, Contract F33615-68-C-1253, Sigmatron, Inc. NTIS.** Arrays of nine cadmium sulfide photoresistive cells each were developed for use in an analog multiplier. The program goals were to achieve a temperature coefficient of the photoresistance below 0.1 per cent °C, a voltage coefficient of the photoresistance less than 0.02 per cent per volt over a 10-volt range, and a response time of less than 10 msec. All photocells met the response time requirements; individual arrays met either the temperature coefficient or the voltage coefficient

requirements. It was shown that the latter two characteristics tended to be mutually exclusive over the desired operating ranges. These differences could be reduced by increasing the photoexcitation intensity. An interpretation of this behavior was made in terms of the various competing electronic processes within a photoconductor. A description is given of the vacuum deposition, heat treatment, electroding and encapsulation processes used. The techniques used for measurement of the temperature and voltage coefficients over an extended range, the response time, the Hall effect and thermally stimulated currents are presented. (60 pp.)

8 **Knoop, P.A. Applications of a simulation analyzer program for deriving and evaluating numerical integration techniques. AFHRL-TR-68-9, AD-687 854. Wright-Patterson AFB, OH: Training Research Division, March 1969. Project 6114. NTIS.** This report describes applications of a Simulation Analyzer Program for deriving or evaluating numerical integration methods for use in flight simulation for training. The FORTRAN program was developed in an earlier study, and its theoretical bases and capabilities are briefly presented in this report. The program is used to derive and evaluate optimal integration methods for application to a selected first-order and a second-order differential system. The program is used to derive and evaluate optimal integration methods for application to a selected first-order and a second-order differential system. The derived methods are used to solve these systems, and actual solution characteristics are compared with those predicted beforehand by the program. Characteristics of accuracy, actual percent error, stability, and error propagation are shown to be accurately predicted, as is the largest integration interval usable for each problem with each integration method. A thorough description is provided of the five popular simulation-integration techniques in use today and of a recommended procedure for using the Simulation Analyzer Program to derive new integration methods which allow maximization of the integration interval for specific simulation problems. As an example, the program is used to evaluate known methods and derive new methods for the F-100A problem using integration intervals of 0.5 and 0.10. A set of over 70 new integration methods derived by the program, including their stability and truncation-error characteristics, is provided. (116 pp.)

9 **Askren, W.B., Bower, S.M., Schmid, M.D., & Schwartz, N.F. A voice-radio method for collecting human factors data. AFHRL-TR-68-10, AD-686 059. Wright-Patterson AFB, OH: Training Research Division, January 1969. Project 1710. NTIS.** Available methods for collecting human factors data rely heavily on observations, interviews, and questionnaires. A need exists for other methods. The feasibility of using two-way voice-radio for this purpose was studied. The data-collection methodology consisted of a human factors analyst talking from a radio base station with technicians wearing portable radio units while they worked on jobs dispersed over an area. Verbal communication probed for information on equipment problems, procedural problems, delays and potential hazards. The concept of using radio equipment to collect human factors data was tested, using technicians performing flight-line maintenance. Data collected by radio were compared with data collected by questionnaire. It was concluded that voice-radio is not only a feasible means of collecting human factors data in the field, but has certain advantages over questionnaires in determining hardware problems and amplifying the data-collection capability of the human factors analyst. (34 pp.)

10 **Taylor, R., Gerber, A., Allen, M., Brown, L., Cohen, E., Dunbar, D., Flexman, R., Hewitt, W., McElwain, D., Pancoe, E., & Simpson, D. Study to determine requirements for undergraduate pilot training research simulation system (UPTRSS). AFHRL-TR-68-11, AD-858 640. Wright-Patterson AFB, OH: Training Research Division, July 1969. Project 6114, Contract F33616-68-C-1604, General Precision Systems, Inc. NTIS.** In order to provide a sound basis for the preparation of specifications defining the requirements for an undergraduate pilot training research simulation system (UPTRESS), a comprehensive study was made of all aspects of current and projected simulator technology; and those techniques of simulation and training which appeared to offer the greatest utility for research purposes were analyzed in detail to determine the form and extent of the capability in each area (e.g., aircraft systems, simulation, motion simulation, visual simulation) which

should be specified for the facility. To assure the Air Force widest possible latitude in its eventual selection of the capabilities to be provided in the facility, alternative approaches of varying levels of complexity are described in a number of areas and the tentative preliminary design requirements set forth in each area are qualified as necessary to permit them to be considered in the light of subsequent decisions by the Air Force regarding research, objectives, training objectives, and level of expenditure. (276 pp.)

11 **Snyder, M.T., & Askren, W.B. Techniques for developing systems to fit manpower resources. AFHRL-TR-68-12, AD-681 137. Wright-Patterson AFB, OH: Training Research Division, October 1968. Project 1710, Contract F33615-67-C-1650, Bunker-Ramo Corporation. NTIS.** This report discusses four related processes for developing systems within manning and skills constraints. The point is made that the services are beginning to feel the need to exert some measure of control over system design where human resources are involved. The report covers: (1) research to prove that certain human resources data, such as manning and skills data, when used as design constraints along with other constraints does affect system design; (2) techniques by which to match or balance through tradeoff practices the hardware, the human and other system support or logistic functions in order to get a best mix depending on the real world operational goals; (3) a new specification by which personnel requirements are stated in terms of system requirements, for integrating more fully the human requirements with the system engineering processes; (4) a newly developed computer based data handling system for human resources data in the conception, development, test and operation of systems. The new data system is also an integrator of human and hardware data within and across systems, and a mechanism for comparing field performance data with early design data. (15 pp.)

12 **Tulley, A.T., Meyer, G.R., Oller, R.G., Mitchell, P.J., Reardon, S E., & Reed, L.E. Development and application of computer software techniques to human factors task data handling problems. AFHRL-TR-68-13, AD-682 362. Wright-Patterson AFB, OH: Training Research Division, November 1968. Project 1710, Contract F33615-67-C-1036, System Development Corporation. NTIS.** Research leading to the application and implementation of techniques for computer handling of human factors task data generated in support of aerospace system development programs is discussed. The technique development is based on the assumption that a user-oriented computerized data handling system will help draw human factors specialists closer to needed data. The application of these techniques should reduce the problem of data accessibility and allow more effective use of data in the system design and development process. A computerized data handling system to store, selectively retrieve, and process human factors data in a user-oriented environment was implemented through a Pilot Study Experimental System (PSES). This experimental system provided the primary means for evaluating the research results. This report discusses the development process of the PSES, the computer software used by the PSES, data classification techniques, and vocabulary controls. Consideration is also given to the feasibility of providing (1) analytic and simulation tools in a user-oriented environment, (2) current awareness notification of data entries, and (3) an advanced and sophisticated classification scheme for identifying functional relationships. (192 pp.)

13 **Rifkin, K.I., Pieper, W.J., Folley, J.D., Jr., & Valverde, H.H. Learner-centered instruction (LCI): the simulated maintenance task environment (SMTE): a job specific simulator. AFHRL-TR-68-14(IV), AD-855 142. Wright-Patterson AFB, OH: Training Research Division, May 1969. Project 1710, Contract AF33(615)-5161, Applied Science Associates, Inc. NTIS.** The purpose of the Simulated Maintenance Task Environment (SMTE) is to provide a means for training and job performance testing of the flight line weapon control systems mechanic/technician for the F-111A aircraft (AFSC 322X1R). The SMTE provides practice in flight line equipment checkout, trouble-shooting, and removal and replacement of line replaceable units in the resident training school or in the field. Also, it is used in conjunction with a performance test designed to measure the technician's ability to perform his job. The SMTE provides a high fidelity simulation of those characteristics of

the task environment which the technician will encounter in the field while performing his job. It provides a capability for insertion of malfunctions and production of the appropriate out-of-tolerance display of fault indication. Failed units can be located, removed and replaced with performance requirements similar to those in the actual aircraft. The fact that the task has been broken down into part-tasks and that part-task training devices have been developed, permits the simultaneous training and testing of several individuals on different aspects of the job. The SMTE has an on-line event recording capability which makes a permanent record of control activations and the sequence of the actions. Because of the simulator's relatively low cost, it may be used frequently by students without incurring high replacement costs in the event of damage to components. It is easily repaired and does not require highly trained personnel to support it. (51 pp.)

14 **Potempa, K.W. A catalog of human-factors techniques for testing new systems. AFHRL-TR-68-15, AD-854 482. Wright-Patterson AFB, OH: Training Research Division, February 1969. Project 1710. NTIS.** This report contains 16 human-factors testing techniques contributed by a number of Air Force and contractor personnel. While limited in number, it covers a broad segment of the human-factors testing spectrum. For example, the techniques presented range from those used during the design and fabrication through those used in field and operational system testing. This catalog was developed as a prototype to determine its usefulness to human-factors personnel as a reference source for human-factors testing devices and techniques. If this prototype finds acceptance, a more comprehensive catalog may be developed. The comprehensive catalog would serve two purposes. First, it would present information about techniques that have not previously been published. Second, it would present in one source most of the techniques currently being used in human-factors testing. (96 pp.)

15 **Kincaid, P.J. A functional model of memory based on physiological and verbal learning data. AFHRL-TR-68-16, AD-694 078. Wright-Patterson AFB, OH: Training Research Division, April 1969. Project 7907. NTIS.** This report presents a functional model of memory based on verbal learning and physiological data. These diverse empirical data are used to describe several basic mechanisms of memory including: (a) separate mechanisms for short-term memory and for long-term memory; (b) the initiation of long-term memory by short-term memory; (c) the properties of short-term memory including autonomous decay, distortion by interference, and a limited capacity; (d) the properties of long-term memory including a consolidation process dependent upon ribonucleic acid (RNA) and enzymes, and a very large capacity; (e) the functional grouping of items in long-term memory; and (f) consolidated (long-term) memories that are reactivated, being brought back into short-term memory. Time courses of these events are described. The ultimate benefits of a detailed knowledge of the mechanisms of memory is to help us to better understand how humans learn. This report describes how mnemonic techniques work and presents suggestions about how to improve memory training. (40 pp.)

Technical report numbers 68-17 through 68-100 were not assigned.

16 **Mullins, C.J., Massey, I.H., & Riederich, L.D. Reasons for Air Force enlistment. AFHRL-TR-68-101, AD-678 527. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7719. NTIS.** The Air Force Questionnaire was administered to four groups of basic airmen under different testing conditions to determine whether or not a questionnaire under consideration would elicit frank and honest responses. In so far as can be determined, the enlistees are giving their real reasons for enlisting in the Air Force. Analysis of responses shows educational opportunities to be the most popular reason for joining the Air Force. (10 pp.)

17 **Traweek, J.H., & Morsh, J.E. Occupational survey of the jet engine mechanic career field 432X0. AFHRL-TR-68-102(I, II, III), AD-705 171. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7734. NTIS.** A job inventory covering four specialties in the Jet Engine Mechanic

Career Ladder, and consisting of 354 tasks grouped under 16 duty categories was administered to 1691 airmen in 15 major air commands. Incumbents of all skill levels completed a background information section and rated on a 7-point scale the relative time spent on tasks. The airmen also indicated on a 7-point scale training required to do the tasks performed. Job descriptions are presented for 14 groups selected according to background information variables. Included are four specialty groups, and 10 groups with differing lengths of military service. Duty and task descriptions are presented for the Jet Engine Mechanic Career Ladder total sample, for nine job type clusters, and for 32 significant job types identified by the automated job clustering program.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected groups. Distributions of background variables for the total sample, for the four specialty groups, and for nine job clusters are also shown. A table indicating how much training is required to perform a task is reported. Responses to items in the background information section are presented for every case in the survey. The inventory of duties and tasks used in the survey is included at the end of this report.

18 **Miller, R.E. Predicting first year achievement of Air Force Academy cadets, class of 1968. AFHRL-TR-68-103, AD-679 988. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7717. NTIS.** Candidates for admission to the Air Force Academy are required to demonstrate their qualifications on a battery of selection tests. Successful candidates, upon admission to the Academy are administered a battery of experimental tests as part of a program for the development of officer selection and classification instruments. The experimental tests are not used in making decisions affecting cadets, but both the selection and experimental batteries are validated against criteria which become available at the end of the fourth class (freshman) year. The criteria used for the validation study in the class of 1968 were the Academic Standard Score, Military Rating, Extracurricular Activities Standard Score, Composite Standard Score, and Early Motivational Elimination. Selection tests common to the classes of 1967 and 1968 tended on the whole to be slightly less valid in the class of 1968. However, the nonacademic selection tests were somewhat more valid in the class of 1968 as predictors of the Military Rating. All criteria were validly predicted by one or more of the experimental tests, but no set of experimental tests was found contributed uniquely and validly to prediction of the Academic Standard Score or Extracurricular Activities Standard Score in the context of the selection tests. The highest multiple correlations with these criteria were .60 and .41, respectively. Sets of experimental tests were found which contributed uniquely and validly to prediction of the Military Rating and Early Motivational Elimination in the context of the selection tests. The highest multiple correlations with these criteria were .54 and .25, respectively. The Composite Standard Score, because of its high correlation with the Academic Standard Score, was not used in any multiple regression analysis. The best predictor of this criterion was the Academic Composite, composed of selection tests. Its validity was .51. (14 pp.)

19 **Miller, R.E. Development of officer selection and classification tests—1968. AFHRL-TR-68-104, AD-679 989. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7717. NTIS.** In accordance with the normal two-year replacement cycle, new forms of the Air Force Officer Qualifying Test (AFOQT) and the AFROTC Pre-enrollment Test (PET) were constructed for implementation in Fiscal Year 1968. Both tests are designated by their fiscal year of implementation. AFOQT-68 closely resembles the previous form in type of content, organization, and norming strategy. It yields Pilot, Navigator-Technical, Officer Quality, Verbal, and Quantitative composite scores. Standardization was accomplished with reference to the Project TALENT battery in a way which permits relating AFOQT scores to performance of Air Force Academy candidates and 12th grade males. A new feature of AFOQT-68 is the provision of separate norms for AFROTC and other use. These norms take into account the effects of differences in level of formal education at the time of testing in various commissioning programs. Differences in educational level are also provided for in

the norms of PET-68. To facilitate test administration, this test is considerably shorter than the previous form but otherwise resembles it. PET-68 yields a total score based on verbal and quantitative items. It is intended as a screening device for AFROTC candidates. (14 pp.)

20 **Lancaster, W.A., & Morsh, J.E. Occupational survey of the outside wire and antenna maintenance career field 361X0. AFHRL-TR-68-105(I, II), AD-705 172. Lackland AFB, TX: Personnel Research Division, August 1968. Project 7734. NTIS.** A job inventory covering four specialties in the Outside Wire and Antenna Installation and Maintenance Career Ladder, and consisting of 367 tasks grouped under 15 duty categories, was administered to 638 airmen in 8 major air commands. Incumbents of all skill levels completed a background information section and rated on a 7-point scale the relative time spent on tasks. The airmen also indicated on a 7-point scale how important they considered the tasks performed, whether extremely important or extremely unimportant. Job descriptions are presented for 20 groups selected according to background information variables. Included are 4 specialty groups and 5 groups with differing lengths of military service. Duty and task descriptions are presented for the Outside Wire and Antenna Installation and Maintenance Ladder total sample, for 3 job type clusters, and for 17 significant job types identified by the automated job clustering program.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected groups. Distribution of background variables for the total sample, for the four specialty groups, and for 20 other groups reported is also shown. In Appendix I responses to items in the background information section are presented for every case in the survey. The inventory of duties and tasks used in the survey is included in Appendix 2.

21 **Valentine, L.D., Jr. Relationship between Airman Qualifying Examination and Armed Forces Qualifying Test norms. AFHRL-TR-68-106, AD-678 528. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7717. NTIS.** Relationships between Armed Forces Qualifying Test (AFQT) norms and Airman Qualifying Examination (AQE) norms were examined. While the norms are not in perfect agreement, the data suggest that they do not vary from each other to any sizable extent. Estimates (through Project TALENT data) of AFQT performance of 15-year-olds, 18-year-olds, and 12th graders were examined, and implications for military test norms were discussed. (7 pp.)

22 **Gregg, G. The effect of maturation and educational experience on Air Force Officer Qualifying Test scores. AFHRL-TR-68-107, AD-687 089. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7717. NTIS.** It is known that maturation and education have an elevating effect on AFOQT scores. Since the AFOQT is administered at different educational levels for the several commissioning programs, differences which are largely spurious exist between the programs with respect to their score distributions. To evaluate the extent of differences produced by maturation and education, the AFOQT was administered experimentally to 415 AFROTC cadets in 32 institutions near the end of their senior year. Scores were compared with those obtained for the same group when they were tested as freshmen or sophomores for selection by the AFROTC program. For the experimental group as a whole, the Officer Quality score showed an increase of approximately 30 percentile points over the national mean for AFROTC applicants. The increase was greatest for cadets in rated categories (Category IP and IN) and in the scientific-technical category (Category II). Because of statistical artifacts, the increase was greater for those whose initial scores were low than for those whose initial scores were high. The increase in Pilot scores for the total group was about 20 percentile points, with the greatest increase (30 to 50 points) occurring in the categories which received light plane training as part of the AFROTC curriculum. The increase in Navigator/Technical scores amounted to about 6 points for the total group, but it approached 30 points for Category II cadets

whose initial scores were below the 75th percentile. Category II cadets had initial scores about 30 points higher than cadets in nonscientific programs (Category III), and this difference persisted in the final testing. Data supported the additional finding that the known stable rank-ordering of institutions with respect to AFOQT scores of freshmen and sophomores applies also to AFOQT scores of seniors. The data also permitted determination of test-retest reliabilities and intercorrelations of AFOQT scores. (12 pp.)

23 **Wiley, L.N., & Cagwin, L.P. Comparing prediction of job performance ratings from trait ratings for aircraft mechanics and administrative airmen. AFHRL-TR-68-108, AD-691 003. Lackland AFB, TX: Personnel Research Division, October 1968. Project 7734. NTIS.** Supervisors in all commands rated aircraft mechanics on overall job performance and on 65 work-related traits. Of 1,290 ratees, there were 852 who were rated by each of two supervisors, providing samples of 83 in DAFSC 43131, 418 in DAFSC 43151, 274 in DAFSC 43171, and 77 in DAFSC 43190. Trait predictions of overall performance yielded R^2s ranging from .78 to .94, and cross-validation R^2s from .33 to .86. Interpretations involved comparisons with previous findings obtained from ratings on adminstrative airmen. The analyses added confirmation in a different career ladder of most of the administrative ladder findings and suggested that there are some areas where the interpretations cannot be generalized from one work situation to another. It was concluded that any supervisor should be able to make this type of rating if given opportunity to observe the man. Particular attention should be given to the opportunity of supervisors to observe men. (26 pp.)

24 **Mayo, C.C. Survey of twenty-eight Air Force career ladders with nineteen job inventories. AFHRL-TR-68-109, AD-687 091. Lackland AFB, TX: Personnel Research Division, July 1968. Project 7734, Contract AF41(609)-3049, Lifson, Wilson, Ferguson, and Winick, Inc. NTIS.** Nineteen job inventories were constructed for survey of 28 Air Force career ladders. Background variables designed to discriminate among subjects were included in each inventory. A review of the contribution of technical advisers to inventory construction showed that airmen at the superintendent and technician levels provided the best job information. Problems arising in inventory construction are discussed and compared with problems encountered in previous research. Write-in information from administrative surveys was reviewed, and significant contributions were added to inventory content. Inventory responses were keypunched and verified in preparation for computation of group job descriptions. (29 pp.)

25 **Vitola, B.M., & Alley, W.E. Development and standardization of Air Force composites for the Armed Services Vocational Aptitude Battery. AFHRL-TR-68-110, AD-688 222. Lackland AFB, TX: Personnel Research Division, September 1968. Project 7717. NTIS.** This report describes the development and standardization of Air Force composites for the Armed Services Vocational Aptitude Battery (ASVAB). Characteristics of ASVAB items, subtests, and descriptive data are presented, as well as intercorrelations among the Airman Qualifying Examination (AQE), Project TALENT tests, and ASVAB variables. Correlation of the ASVAB composites with those of AQE-66 and Project TALENT indicates a high degree of relationship. Similarly, comparison of means and standard deviations derived from the norming samples of AQE-66 and the ASVAB indicates little difference between the samples. Finally, application of the Kuder-Richardson Formula 21 results in high reliability coefficients for the ASVAB composites: General AI .86, Administrative AI .91, Mechanical AI .84, and Electronics AI .91. Because of the high relationships between the aptitude composites of the ASVAB and the AQE, the AQE distributional data currently in use in selective recruiting programs and in the high scool testing program are considered to be valid and generalizable to Air Force aptitude indexes derived from the ASVAB. (14 pp.)

26 **Mullins, C.J., Keeth, J.B., & Riederich, L.D. Selection of foreign students for training in the United States Air Force. AFHRL-TR-68-111, AD-683 725. Lackland AFB, TX: Personnel Research Division, November 1968. Project 7719. NTIS.** A group of tests has been used to predict success in

pilot and technical training for groups of foreign nationals trained in the United States. In addition to previous flying experience two types of tests were tried: paper-and-pencil and performance tests, hopefully of low cultural loading. For those going into pilot training without previous pilot experience, one performance test, rudder control, gave the highest prediction, with one of the paper-and-pencil tests adding significantly. For technical training, five paper-and-pencil tests showed low but significant prediction.

It is noted that three of the paper-and-pencil tests, used alone, are significantly valid for pilot training and can make considerable improvement in pilot trainee selection procedures. (17 pp.)

27 **Valentine, L.D., Jr., Vitola, B.M., & Guinn, N. Revision and standardization of the radio operator composite. AFHRL-TR-68-112, AD-688 223. Lackland AFB, TX: Personnel Research Division, October 1968. Project 7717. NTIS.** The Radio Operator Aptitude Index is used to select non-prior-service personnel for the Communications Operations (29) career field. This report describes a revised Radio Operator Composite which appears to predict success in technical school as well as the previous form. Scoring and processing procedures are explained in detail so that this technical report may also serve as a scoring manual for test administrators. The revised method of computation will result in a reduction of testing, scoring, and processing man-hours. Technical data relevant to the revision are presented in the appendix. (10 pp.)

28 **Sturiale, G. The officer effectiveness report as a performance measure: a research review. AFHRL-TR-68-113, AD-691 002. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7719. NTIS.** This report reviews a decade of research concerned with the Air Force Officer Effectiveness Report. One major group of studies concerns the OER used as a performance measure for personnel management purposes. This group includes analyses of relationships between officer effectiveness ratings and such situational and demographic factors as AFSC, grade, command, and education. The second area of research includes studies designed to determine the relationships between certain variables and officer performance where the OER has been used as a criterion measure for this performance. These investigations are concerned for the most part with measurement and improvement of officer selection devices and training programs. An attempt was made to examine critically the results obtained and arrive at whatever empirical and interpretive generalizations such a diversity of data permits. (20 pp.)

29 **Tupes, E.C., & Dieterly, D.L. Adjusted OER scores with inflation effects removed. AFHRL-TR-68-114, AD-688 537. Lackland AFB, TX: Personnel Research Division, November 1968. Project 7719. NTIS.** A method was developed to remove the effects of inflation and form changes from numerically coded OER overall ratings. Application of the technique permits more accurate comparisons of officer effectiveness between groups and across time. Some such comparisons are illustrated using data obtained from the Project M file of officers on active duty at the end of 1967. The feasibility of the adjusted OER technique is demonstrated in these comparisons between various subgroups of the total officer population. (12 pp.)

30 **Vitola, B.M. Development and standardization of the Airman Classification Test–1968. AFHRL-TR-68-115, AD-687 090. Lackland AFB, TX: Personnel Research Division, September 1968. Project 7717. NTIS.** The Airman Classification Test is used by the United States Air Force for all airman classification programs except selective enlistment. It yields four aptitude indexes comparable to those of the Airman Qualifying Examination: Mechanical, Administrative, General, and Electronics; the ACT-68 is more similar to the AQE than the 1964 form. The ACT-68 may be scored by hand or by machine. Modification and simplification of the scoring system should result in increased ease of administration and economy when the test is scored in the field. (6 pp.)

31 **Dieterly, D.L. Simplified approach to a manpower management model. AFHRL-TR-68-116, AD-688 538. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7719. NTIS.** A manpower management model was designed to reflect four factors of concern to personnel managers: procurement, training, reassignment, and retention. Within the framework of this model, seven basic indexes were developed to yield simple, reliable descriptive data by which a manpower structure can be assessed at given points in time. These indexes permit evaluation of the consequences of past policies and anticipation of needs for future policy change. By means of the simple ratio indexes, specific manpower problem areas can be identified, and force strength can be compared across seven dimensions (loss, retention, gain, flow, transfer, utilization, and stability) and at various levels within an organization. (12 pp.)

32 **Kaplan, M.N., Madden, H.L., & Tupes, E.C. Estimates of OER distributions by Air Force officers. AFHRL-TR-68-117, AD-691 004. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7719. NTIS.** When officers in grades Second Lieutenant through Colonel were asked to estimate percentages of officers represented in each of the ten rating boxes of the overall evaluation on the Officer Effectiveness Report (OER), accuracy of estimation of actual OER distributions varied as a function of (*a*) the grade of the rater, (*b*) the grade being estimated, (*c*) interaction between rater's grade and the grade being estimated, and (*d*) other characteristics of rater, particularly duty assignment. Although most officers appeared to be aware of inflation in OERs, the extent of this problem was not fully realized. (22 pp.)

33 **Tupes, E.C., Dieterly, D.L., Fortuna, A.L., & Madden, H.L. Development of a data base for an AFROTC management control system. AFHRL-TR-68-118, AD-688 539. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7719. NTIS.** This report describes the origin and rationale of the concept of an AFROTC Management Control System, and the development of a data base upon which such a system must depend. A detailed list and descriptions of all variables in the data base are included. Some example distributions are included to illustrate the type and magnitude of differences existing between the various AFROTC detachments. It is concluded that substantial improvements in the cost-effectiveness of the AFROTC program are possible through the use of the AFROTC Management Control System but that the interrelationships between the various factors entering into such a system are so complex that the use of an electronic computer in the data analyses is a necessity. (22 pp.)

34 **Tupes, E.C., & Madden, H.L. Prediction of officer performance and retention from selected characteristics of the college attended. AFHRL-TR-68-119, AD-688 540. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7719. NTIS.** This report describes analyses of relationships between military performance and retention rates of officers entering active duty from each of 172 AFROTC detachments during the period 1958-62 and characteristics of the colleges and universities at which the detachments are located. The analyses indicate that the differences between AFROTC detachments are primarily due to differences in the student bodies of the colleges and to a great extent are beyond the control of the Professors of Air Science or their staffs. It appears, then, that retention rates of AFROTC graduates can be increased by differential assignment of quotas to AFROTC detachments or by disestablishment of certain detachments. Implications of the study for the Officer Training School Recruiting and Selection systems are discussed. (12 pp.)

35 **Phalen, W.J. Occupational survey of the inventory management and materiel facilities career ladders 645X0/647X0. AFHRL-TR-68-120, AD-705 173. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7734. NTIS.** A job inventory covering eight specialties in the Inventory Management and Materiel Facilities Career Ladders, and consisting of 291 tasks grouped under 15 duty categories, was administered to 1790 airmen in 16 major air commands. Incumbents of all skill levels completed a background information section and rated on a 7-point scale relative time spent on tasks. The airmen also indicated on a 7-point scale how much training emphasis should be

given to the tasks performed. Job descriptions are presented for 10 "special" groups selected according to background information variables. Included are four DAFSC groups and one total sample group for each career ladder. Duty and Task descriptions are presented for the total Inventory Management and Materiel Facilities sample, for 10 major job-type clusters, for 7 job-type subclusters, and for 83 significant job types identified by the automated job clustering program.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Group summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for DAFSC and career ladder groups. Distributions of background variables for the total sample, the 10 major job-type clusters, and the 7 job-type subclusters are also shown. Also included are distributions of background variables for the 2 career ladders and 8 specialty groups. Responses to items in the background information section are presented for every case in the survey. The complete inventory of duties and tasks used in the survey is also included.

36 **Mead, D.F. Occupational survey of the intelligence operations (204X0) and photo interpretation (206X0) career ladders. AFHRL-TR-68-121(I, II), AD-692 530 and AD-692 531. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7734. NTIS.** A job inventory covering the Intelligence Operations and Photo Interpretation Career Ladders, and consisting of 356 tasks grouped under 15 duty categories, was administered to 1,627 airmen in 15 major air commands. Incumbents of all skill levels completed a background information section, indicated each task performed in their present job and rated on a 7-point scale the relative time spent on those tasks performed. The airmen also indicated on a 7-point scale the source of training for each task performed. Job descriptions are presented for 8 specialty groups, for the Intelligence Operations and Photo Interpretation Career Ladders total samples, the combined total sample, five major job clusters, and for 64 significant job types identified by the automated job clustering program.

Group overlap matrices show the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected groups. Distribution of background variables for the total samples. DAFSC groups, major clusters and job types are also shown. The inventory of duties and tasks used in the survey is included in the appendix.

37 **Morsh, J.E., Aitken-Cade, P.B., & Boyce, S.B. Occupational survey of the weapon control systems career ladder 322XX. AFHRL-TR-68-122 (I, II), AD-705 174. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7734. NTIS.** A job inventory covering four specialties and their shredouts in the Weapon Control Systems Career Ladder (AFSC 322X1), and consisting of 572 tasks under 16 duty categories, was administered to 1319 airmen in 10 major air commands. Incumbents of all skill levels completed a background information section and rated on a 7-point scale relative time spent on tasks. The airmen also indicated on a 7-point scale how they learned to do the tasks performed, whether from school training or work experience. Job descriptions were computed for 45 groups selected according to background variables; however, of these only the 19 AFSC job descriptions are presented in this report. Job descriptions are also presented for the Weapon Control Systems Career Ladder total sample, 5 job type clusters, and 33 significant job types identified by the automated job clustering program.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected pairs of specialties. Distributions of background variables for the total sample, job type clusters, job types, and for the DAFSC groups are also shown. An analysis of the ratings for the method of training is presented for the four DAFSC groups and three shredout groups.

38 **McClure, G.E. Job-associated problems encountered by airmen in Southeast Asia as reported by returnees. AFHRL-TR-68-123, AD-689 750. Lackland AFB, TX: Personnel Research Division, December 1968. Project 7734, Contract AF41609-68-C-0034, Data Dynamics, Incorporated. NTIS.** This report documents a survey of United States Air Force personnel concerning their jobs in Vietnam and Thailand. The report describes the preparation of updated Air Force Job Inventories, selection of the study population, conduct of a mail survey, and personal interviews with commissioned officers and airmen. Primary purposes of the mail survey were to identify tasks in Southeast Asia jobs in which airmen experienced difficulty and to identify individuals for later personal interview.

Interviews were conducted to probe deeper into matters mentioned by respondents in the mail survey, to compare jobs in Southeast Asia with the same jobs elsewhere in the Air Force, to ascertain difficulties in reaching or maintaining proficiency, and to determine the extent to which the existing Air Force system prepares airmen for jobs in Vietnam and Thailand.

The study population was comprised of airmen in 40 different career specialties and a sampling of commissioned officers who supervised airmen in one or more of the same fields. Mail survey results included responses from 4,119 airmen and 689 commissioned officers. The personal interview sample consisted of 654 airmen and 127 commissioned officers.

Analysis of both mail and interview responses indicated that the job tasks in the 40 specialties in this study are essentially the same in Southeast Asia as they are elsewhere in the Air Force. Respondents reported a need for more training on only a relatively small number of tasks in each specialty. Most job-related difficulties were reported as being caused by factors other than a lack of proficiency of airmen. (28 pp.)

39 **Barlow, E. Abstracts of personnel research reports: VIII. 1954–1968. AFHRL-TR-68-124, AD-695 483. Lackland AFB, TX: Personnel Research Division, December 1968. Projects 6755, 7717, 7719, 7734. NTIS.** This volume includes abstracts of the 444 technical reports issued by the Personnel Research Division and its antecedent organizations from January 1954 through December 1968. They cover studies in selection, classification, and utilization of Air Force personnel; systematizing information flow in support of personnel planning; methods of describing, evaluating, and structuring Air Force jobs; and development of procedures for improving the quality of Air Force personnel. (160 pp.)

40 **Fligor, P.D. Study of data sources and processing for radar land mass simulation. AFHRL-TR-69-1, AD-692 122. Wright-Patterson AFB, OH: Training Research Division, June 1969. Project 6114, Contract F33615-68-C-1300, Technology Incorporated. NTIS.** To generate input data with a 50-foot resolution and fifteen shades of gray for advanced high-resolution digital radar simulators, this research examined and defined data sources and processing techniques. Limited to the Continental United States and to unclassified information, the data sources included all known aerial mapping imagery and topographic maps. All existing image processing techniques and devices were examined to define their operating principles. This review led to the conclusion that adequate geometric information for radar simulation data could be extracted from the current data sources and that existing processing capabilities could be combined into a feasible automatic system. In related work, nonparametric three-dimensional resections were calculated on a digital computer, and mathematical concepts were developed to give a computer system the capability of interpreting the physical characteristics in photos by using cues as done by a trained photo interpreter. Recommendations include examination of real imagery in statistically significant quantities to establish the probabilities of encountering given shape, size, and materials of objects in the real world; fabrication of a breadboard system to prove the operating concepts of a proposed image reader; examination of the communication between a computer's central processor and the reader device to optimize parallel processing for logical inference decision making; and after the verification of new concepts, the initiation of a design effort to culminate in an automatic processing system. (78 pp.)

41 **Horton, J.A., Emerick, R.M., & Mount, J.E. Research in the development and application of nonglass optical infinity display techniques for visual simulation. AFHRL-TR-69-2, AD-639 651. Wright-Patterson AFB, OH: Training Research Division, July 1969. Project 6114, Contract F33615-67-C-1531, Goodyear Aerospace Corp. NTIS.** Infinity displays possess many desirable properties that enhance the training value of aircraft flight simulators. In the past, little has been done to apply reflecting infinity display techniques to the problem of wide-angle visual simulation. This is primarily because glass mirrors were necessary to obtain the needed optical quality. These mirrors were heavy, fragile, expensive, and took a long time to manufacture. Additional support structures and control systems required by glass mirrors only added to the cost and complexity. Objectives of the nonglass infinity display research program were to study wide-angle display system concepts, develop high-quality non-glass mirrors and fabrication techniques, build a prototype display system, and define cathode ray tube characteristics needed for the display. A prototype unit using nonglass mirrors was fabricated having a 120-degree horizontal field of view and a 45 degree vertical field. (61 pp.)

42 **Herzberg, F.I., Winslow, E.K., & Majesty, M.S. Motivational engineering for pilot training. AFHRL-TR-69-3, AD-702 123. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 1710, Contract F33615-68-C-1535, Case Western Reserve University. NTIS.** This study was an investigation of student pilot motivation for, and attitudes toward, the Air Training Command's Undergraduate Pilot Training (UPT) program. The motivation-hygiene approach was used to systematically identify the motivational factors operating in the UPT program. This approach has been used extensively in industry and with success in a non-training military situation. This was the first time that the motivation-hygiene approach was used to investigate motivation in a trainee population. The purposes of the study were: (1) to employ motivation-hygiene theory and critical incident interview methodology for investigation of motivation in a military training situation, specifically, Undergraduate Pilot Training; (2) to compare the findings from the undergraduate Pilot Trainee sample with another Air Force sample and samples from industrial organizations. Once the motivational factors operating in the UPT program have been determined, the information can be used to design a "motivationally engineered" training program. Motivational engineering in UPT has the potential not only for improving student pilot performance, but also for reducing student pilot attrition. An Air Force documentary film, SPR-6-70, entitled Motivational Engineering for Undergraduate Pilot Training, summarizes the findings of this study. (43 pp.)

43 **Pieper, W.J., Folley, J.D., Jr., & Valverde, H.H. Learner-centered instruction (LCI): description of the job performance test. AFHRL-TR-69-4(V), AD-692 125. Wright-Patterson AFB, OH: Training Research Division, June 1969. Projects 1710, 686F, Contract AF33/615/05161, Applied Science Associates, Inc. NTIS.** A description is presented of the development of a job performance test for the Learner-Centered Instruction (LCI) Weapon Control Systems Mechanic/Technician, Air Force Specialty Code (AFSC) 322X1R course which was conducted at Lowry Air Force Base, Colorado, from August through December 1968. The performance test was administered to the LCI experimental course subjects as well as the control course subjects upon graduation. The test will also be administered to these subjects in a field follow-up evaluation at Nellis AFB, Nevada, five months after graduation. The test items are, for the most part, based on tasks derived from the behavioral description of the actual job. The test contains three major parts: (1) Operational Checkout, (2) Troubleshooting, and (3) Auxiliary Task Performance. Most of the Test items are performed on the Simulated Maintenance Task Environment (SMTE), a simulator used for F-111A flight line electronics maintenance testing and training. The actual job performance test is not included in this descriptive report, however, sample items are presented. Since paper-and-pencil tests, in general, measure knowledge about the trainee's job rather than the ability of the trainee to perform required job behaviors, it is concluded that performance tests should be used to evaluate desired job terminal behaviors of training programs. (13 pp.)

44 **Snyder, M.T., Kincaid, J.P., & Potempa, K.W. Proceedings of the Human Factors Testing Conference, 1–2 October 1968. AFHRL-TR-69-6, AD-866 485. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 1710. NTIS.** On 1–2 October 1968, a conference on human factors testing was held to discuss the problems, techniques, and methods associated with this field. Representatives from the Air Force, Army, Navy, NASA, and private industry discussed mutual areas of interest. The 20 presentations dealt with the following five aspects of human factors testing: (1) the history, (2) descriptions of several testing programs, (3) models useful in structuring testing, (4) devices and techniques used, and (5) management problems and procedures. An interpretation and summary of the conference discussion and papers are also included in this report. (302 pp.)

45 **Connelly, E.M., Schuler, A.R., & Knoop, P.A. Study of adaptive mathematical models for deriving automated pilot performance measurement techniques: model development. AFHRL-TR-69-7(I), AD-704 597. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 6114, Contract F33615-68-C-1278, Melpar, An American – Standard Company. NTIS.** This report documents research on a new approach to deriving human performance measures and criteria for use in automatically evaluating trainee performance. The ultimate application of the research is to provide methods for automatically measuring pilot performance in a flight simulator or from recorded in-flight data. An efficient method of representing performance data within a computer is described. A system of adaptive mathematical and computer models is developed to examine representative performance data corresponding to known skill-levels and to independently develop a unique method of performance evaluation. Three types of models are developed, each of which is designed to derive and use (in an adaptive performance evaluation scheme) unique types of performance measures: (1) State-transfer measures, which are based on overall trends of the performance; (2) Absolute measures, which are based on a comparison of actual performance with some reference or standard; and (3) Relative measures, which are based on relations among various performance variables. A preliminary demonstration and an evaluation of the system are made, using a simulated aircraft landing model program to provide hypothetical test data. (296 pp.)

46 **Connelly, E.M., Schuler, A.R., & Knoop, P.A. Study of adaptive mathematical models for deriving automated pilot performance measurement techniques: appendices. AFHRL-TR-69-7(II), AD-704 115. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 6114, Contract F33615-68-C-1278, Melpar, An American – Standard Company. NTIS.** This report documents research on a new approach to deriving human performance measures and criteria for use in automatically evaluating trainee performance. The ultimate application of the research is to provide methods for automatically measuring pilot performance in a flight simulator or from recorded in-flight data. An efficient method of representing performance data within a computer is described. A system of adaptive mathematical and computer models is developed to examine representative performance data corresponding to known skill-levels and to independently develop a unique method of performance evaluation. Three types of models are developed, each of which is designed to derive and use (in an adaptive performance evaluation scheme) unique types of performance measures: (1) State-transfer measures, which are based on overall trends of the performance; (2) Absolute measures, which are based on a comparison of actual performance with some reference or standard; and (3) Relative measures, which are based on relations among various performance variables. A preliminary demonstration and an evaluation of the system are made, using a simulated aircraft landing model program to provide hypothetical test data. (514 pp.)

47 **Williams, R.H., Talbert, G.E., Cochran, T.C., Jr., & Potter, K.W. Overall application of computer technology to the education and research progams of Air University. AFHRL-TR-69-8, AD-703 730. Wright-Patterson AFB, OH: Training Research Division, December 1969. Project 686F, Contract F33615-68-C-1048, System Development Corp. NTIS.** The determination of the overall application of computer technology to the education and research activities of Air University was

undertaken by the study team. This problem required that the need for computer assistance throughout the University be assessed. Further, it required the need for computer assistance to be translated into a set of adequate system requirements. Twenty-five units of Air University were identified for individual in-depth study. Upon completion of each study, a document was prepared, reviewed, revised and published. This activity constituted Phase I of the study. The information thus collected provided the data required for analysis. The analysis, performed within Phase II, indicated the set of functional education and research activities which were amenable to and would benefit most from the application of computer assistance. Further analysis identified the computer-based functional capabilities required. The conclusion derived from this analysis activity is that Air University should start action to procure an on-line interactive time-shared primary mission computer system which is capable of background production with batch processing availability. This Technical Report details the findings of the entire study. Recommendations regarding the system components – equipment, software and personnel are enumerated. Suggested system configuration options are identified, of which each is capable of providing the required application of computer technology to the education and research activities of Air University. (186 pp.)

48 **Weed, H.R., Smith, M.L., & Frasher, R.D. Educational program for scientists and engineers at Wright-Patterson Air Force Base. AFHRL-TR-69-9, AD-702 867. Wright-Patterson AFB, OH: Training Research Division, January 1970. Project 686F, Contract F33615-68-C-1056, The Ohio State University Research Foundation. NTIS.** This contract, a pilot study of Project Innovate Task C, calls for development of programs to update Air Force scientists, engineers, senior technicians, and managers of science and engineering, both military and civilian, who work in research and development at Wright-Patterson Air Force Base. The programs shall provide current knowledge and information to professional employees to help them stay abreast of rapidly advancing technology in their own and related specialties. Phase I reports identification of needs and available training programs. Needs in continuing education were assessed from: (1) existing personnel and training records, (2) questionnaries distributed to all appropriate personnel at WPAFB, (3) personal interviews with five percent of engineers and scientists, and (4) group interviews with management personnel of all laboratories and divisions. While present level of participation in educational and training programs is sizable, there is a clear need for greatly expanded educational programs. The nature of these needs and suggested methods for meeting them at WPAFB is described. The Phase II lists recommendations for educational programs to meet the continuing education needs at Wright-Patterson Air Force Base and suggests the administrative organization for implementing these programs. (178 pp.)

49 **A'Hearn, F., Daniel, J.N., Jr., Enright, C.S., Giggey, F.W., Torr, D.V., & Zappala, A.G. The system life cycle: a defense weapon system scenario simulation model. AFHRL-TR-69-10, AD-878 577. Wright-Patterson AFB, OH: Training Research Division, April 1969. Project 686F, Contract F33615-68-C-1079, Peat, Marwick, Livingston & Co., and Sterling Institute. NTIS.** In order to provide a learning aid with which students in the Defense Weapon System Management Center could gain experience in a wide variety of decisions in various interrelated functional areas throughout a weapon system life cycle, a simulation model was formulated. This simulation consists of a life cycle scenario for a fictitious "Conqueror" surface to surface missile system, with manual and computer assisted student exercises at 35 critical decision points. These exercises cover the full range of functional areas and program phasing, and are keyed to material and decision techniques covered in concurrent classroom instruction. The student receives a "school solution," in terms of the next increment of the scenario, at the conclusion of each exercise. The scenario and exercise outlines have been completed. Recommendations for the preparation of detailed supporting material for each exercise and certain unique software are included so that the simulation may be used in the training of weapon system managers. (167 pp.)

50 **Hill, J.W., Gardiner, K.W., & Bliss, J.C. Design study of a tactile cuing system for pilot training. AFHRL-TR-69-12, AD-697 991. Wright-Patterson AFB, OH: Training Research Division, August 1969. Project 1710, Contract F33615-68-C-1435, Stanford Research Institute. NTIS.** Several vibrator, air jet, and moving-button tactile stimulator-units were evaluated as cuing aids for pilot training in a manual tracking task. The best units, as determined by minimum mean square error and best operator describing function were built into a flight simulator. These units were further evaluated for their ability to help pilots control the trainer in some flight-simulation tracking tasks such as altitude holding and ILS landing. A one-dimensional tactile cuing system was designed using information obtained from these experiments. The cuing system, which consisted of two vibrators attached to the arms indicating heading error in excess of five degrees, was tested in a controlled experiment with four pilots having less than 200 hours of flight time. The two pilots using the cuing system learned significantly faster than the two pilots not using the system. This increased learning rate, however, was only seen when the pilots were engaged in side tasks such as problem solving and the taking of clearances. Plans for a more complete test of this cuing system and for possible extensions of cuing system to other aircraft variables are suggested. A selected review of the literature and current research was carried out to assess the feasibility and appropriateness of biostimulation and bioelectric control for pilot training and aircraft control. (122 pp.)

51 **Horton, J.A., & Bartucci, J.F. Development of lightweight infinity optics display for field evaluation. AFHRL-TR-69-13, AD-696 696. Wright-Patterson AFB, OH: Training Research Division, August 1969. Project 6114, Contract F33615-67-C-1985, Goodyear Aerospace Corporation. NTIS.** Goodyear Aerospace designed, fabricated and delivered a light-weight infinity optics display to the Air Force for attachment to a C-130E aircraft simulator and field evaluation by local personnel. Performance objectives were for a system providing a 54-deg by 41-deg field of view, 12-in. exit pupil, 6 percent distortion, 800 TV lines resolution, 5-ft-L brightness from a TV input; and ability to vary apparent viewing range from 100 ft to infinity. All objectives except for distortion were met. The final developed system consists of two large lightweight spherical mirrors, two large beamsplitters, two refractive correcting lenses, and a high-resolution high-brightness TV monitor that was specially developed during the program to fulfill the above requirements. The system as delivered represents a significant advance in the state-of-the-art for lightweight, low-cost visual simulation displays. (55 pp.)

52 **Schumacker, R.A., Brand, B., Gilliland, M.G., & Sharp, W.H. Study for applying computer-generated images to visual simulation. AFHRL-TR-69-14, AD-700 375. Wright-Patterson AFB, OH: Training Research Division, July 1969. Project 6114, Contract F33615-69-C-1280, General Electric Company. NTIS.** This report describes the results of a system design study for applying digital image generation techniques to visual simulation for pilot training. The computer generated images are to provide out-the-window scenes for a flight simulator which is to be used for training Air Force pilots. No existing visual system can provide all of the capabilities which are desired in a flight simulator. Digitally generated scenes do overcome many of the shortcomings associated with more conventional approaches but have had limited application because of the difficulty of computing enough image detail. The ability to generate images of more complex and realistic environments is closely tied to advances in digital device technology. The study assesses the impact of recent developments in this area on the design of an image generating system. The conceptual design of an image generator is described. The principles of operation, the system configuration and operational characteristics are discussed. Several key problem areas are explored in depth. Feasible methods of implementation with presently available hardware are examined and an estimate of the hardware complexity is given. (131 pp.)

53 **Pieper, W.J., Folley, J.D., Jr., & Valverde, H.H. Learner-centered instruction (LCI): course methodology and administration. AFHRL-TR-69-15(VI), AD-702 521. Wright-Patterson AFB, OH: Training Research Division, June 1969. Project 686F, Contract F33615-67-C-1936, Applied Science Associates, Inc. NTIS.** A description is presented of an experimental Learner-Centered Instruction

course for the F-111A Weapons Control System Technician (322X1R). The course differs from the conventional course as follows: (1) content of course materials, (2) type of training aids, (3) typical mode of instruction, (4) length of course, and (5) expected proficiency of graduates. Several instructional media and devices were used, including programmed books, teaching machines, and task simulators. The course was divided into the following seven major blocks: introduction, checkout, proceduralized troubleshooting, logical troubleshooting, other topics (Boresight; Remove and Replace), transition (from school to job), and whole-task practice. Each student proceeded through the prepared instructional materials at his own pace within each block. Air Force instructors presented the course at Lowry Technical Training Center. Eighty students, 40 with high (80-95) Airman Qualifying Examination (AQE) electronic scores and 40 students with medium (60-75) scores, attended the 14-week course. The higher-aptitude students took less time to complete the required materials, made an average of 10 percent fewer errors on the end of block tests, and learned to complete equipment checkout in less time than the medium aptitude students. Recommendations covering instructor orientation, training devices, method of instruction, student selection, trouble-shooting materials, and equipment utilization are included. Evaluation of course effectiveness, in comparison with the conventional course is pending. (38 pp.)

54 **Crites, C.D. Miniature event recording as a technique for personnel subsystem test and evaluation. AFHRL-TR-69-16, AD-700 100. Wright-Patterson AFB, OH: Training Research Division, September 1969. Project 1710, Contract F33615-68-C-1476, McDonnell Douglas Astronautics Company – East. NTIS.** A study was performed to develop new Personnel Subsystem Test and Evaluation (PSTE) techniques for use during Categories I, II and III Testing of ground operator and maintenance functions. This report describes the development, modification, and refinement of a miniature event recording system as a PSTE technique. Equipment and operational procedures developed for the technique were evaluated under various conditions, including Category II Testing at an Air Force base. Results showed the utility of the event recording technique for quantitative task assessment and video tape data reduction. Specific recommendations are given for use of this technique from system concept through operational use. (85 pp.)

55 **Crites, C.D. Press camera with polaroid back technique for personnel subsystem test and evaluation. AFHRL-TR-69-17, AD-700 101. Wright-Patterson AFB, OH: Training Research Division, September 1969. Project 1710, Contract F33615-68-C-1476, McDonnell Douglas Astronautics Company – East. NTIS.** A study was performed to develop new Personnel Subsystem Test and Evaluation (PSTE) techniques for use during Categories I, II and III Testing of ground operator and maintenance functions. This report describes the development, modification, and refinement of a press camera system as a PSTE technique. Equipment and operational procedures developed for the technique were evaluated under various conditions, including Category II Testing at an Air Force base. Results showed the utility of the camera technique for human engineering and task assessment. Specific recommendations are given for use of this technique from system concept through operational use. (66 pp.)

56 **Crites, C.D. Video tape recording as a technique for personnel subsystem test and evaluation. AFHRL-TR-69-18, AD-700 102. Wright-Patterson AFB, OH: Training Research Division, September 1969. Project 1710, Contract F33615-68-C-1476, McDonnell Douglas Astronautics Company – East. NTIS.** A study was performed to develop new Personnel Subsystems Test and Evaluation (PSTE) techniques for use during Categories I, II, and III Testing of ground operator and maintenance type functions. This report is concerned with the development, modification, and refinement of a video tape recording system as a PSTE technique. Equipment and operational procedures developed for the technique were evaluated under various conditions including Category II Testing at an Air Force base. Results showed the utility of the video tape recording technique for design and procedures development and training functions as well as for PSTE. Specific recommendations are given for efficient use of this technique from system concept through operational use. (192 pp.)

57 **Tupes, E.C., & Miller, R.E. Equivalence of AFOQT scores for different educational levels. AFHRL-TR-69-19, AD-703 727. Lackland AFB, TX: Personnel Research Division, September 1969. Project 7717. NTIS.** It is known that formal education has the effect of elevating AFOQT scores. In this study the magnitude and validity of these effects for each composite were evaluated, taking AFROTC and OTS applicants as representative of two different educational levels at the time of testing. For the Pilot composite, separate conversion tables appropriate to the two levels were constructed by determining flying deficiency elimination rates for both groups at each Pilot percentile and assuming that equal elimination rates represent equal aptitude. For all other composites, separate tables were constructed by using the Department of Defense Officer Record Examination (DORE) as a control of academic aptitude and making equipercentile conversions from an AFOQT distribution in the AFROTC sample to the corresponding distribution in an OTS sample through the DORE distributions. It was found that the increase in scores between the two educational levels is from approximately 10 to 30 percentile points for the various composites, except where initially high scores limit the amount of increase. A third set of conversion tables was constructed intermediately between the AFROTC and OTS tables for use with examinees having intermediate levels of education. The use of multiple tables imparts the same meaning to a given percentile value in any program, provided the proper table is used in converting the raw score. One consequence of multiple tables is that examinees evaluated on the intermediate or OTS tables will be disqualified for various types of training more frequently than was the case when only one set of tables, corresponding to the AFROTC tables, was used. However, the aptitude levels of those who are selected will be higher than heretofore, and it is expected that graduation rates will reflect this difference. The potential increase in graduation rate is estimated at 5 percent for student pilots commissioned through OTS. (9 pp.)

58 **Kibbee, J.M., Vickman, L., Dent, E.M., Dominguez, L.F., & Stellmach, A.T. TOP-MAN-X: a management simulation for instruction in total programming and the base engineer automated management system (BEAMS). AFHRL-TR-69-20, AD-704 892. Wright-Patterson AFB, OH: Training Research Division, September 1969. Project 686F, Contract F33615-68-C-1076, Technical Communications, Inc. NTIS.** TOP-MAN-X, a management game developed primarily for the Civil Engineering School of the Air Force Institute of Technology at Wright-Patterson AFB, Ohio, is used to assist in the instruction of USAF personnel in Total Programming. Total Programming is a USAF developed set of concepts and procedures for the optimum allocation of resources to the operation and maintenance of real property facilities on an Air Force base. TOP-MAN-X is a manual "suitcase" management game. This report includes a short introduction to Total Programming, a discussion of TOP-MAN-X and the various steps in its development, and concludes with some remarks on the automation of both TOP-MAN-X and Total Programming. (47 pp.)

59 **Highcove, J.E., Stout, R., Hoberman, M., & Stellmach, A.T. Base engineer automated management system (BEAMS): implementation/conversion team education. AFHRL-TR-69-21, AD-701 390. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 686F, Contract F33615-68-C-1076, Technical Communications, Inc. NTIS.** This report describes the nature, purpose and method of development of the Base Engineer Automated Management System (BEAMS) Implementation/Conversion (I/C) Team Education Course. It includes a short discussion of the content, history and development of BEAMS from its inception in 1964 to its initial test at Langley AFB in 1968. Implementation/Conversion is defined and described in terms of the responsibilities of major air commands and bases for the creation of the initial BEAMS data bank. The concept of the I/C teams is examined and the necessity for successful Implementation/Conversion is related to the success of the entire BEAMS program. I/C course content is contrasted with that of the regular BEAMS courses which were subsequently taught at AFIT, with special emphasis on the structure of course materials and teaching objectives. (51 pp.)

60 **Meister, D., Sullivan, D.J., Finley, D.L., & Askren, W.B. The effect of amount and timing of human resources data on subsystem design. AFHRL-TR-69-22, AD-699 577. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 1710, Contract F33615-68-C-1367, Bunker-Ramo Corp. NTIS.** The purpose of this study was to (1) determine whether the amount and timing of human resources data (HRD) influence design; (2) to investigate the effect upon design of differences in type of personnel requirements. Eight engineers were required to design the maintenance equipment for the AGM-69A, using equipment and HRD inputs produced for the actual equipment. One group received all HRD inputs plus stringent personnel constraints at the start of design; a second group received the same inputs plus "minimal" personnel constraints incrementally. It was found that the amount and timing of HRD inputs do influence design when these inputs are phrased as design requirements. The type of manpower requirement imposed also appeared to make some difference to subjects. Skill is considered by engineers to be of greater significance to system performance than numbers of personnel. Engineers prefer to receive their HRD inputs as early in design as possible. The estimates made by engineers of personnel required to operate and maintain their systems do not always seem to relate to their design concepts. Recommendations are made for the inclusion of personnel requirements in Requests for Proposal and Statements of Work. The need for additional research to describe the design implications of HRD inputs is pointed out, together with the desirability of using Air Force operational sites as a research laboratory. (144 pp.)

61 **Meister, D., Sullivan, D.J., Finley, D.L., & Askren, W.B. The design engineer's concept of the relationship between system design characteristics and technician skill level. AFHRL-TR-69-23, AD-699 578. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 1710, Contract F33615-68-C-1367, Bunker-Ramo Corp. NTIS.** The purpose of this study was to investigate the relationships between design characteristics and skill dimensions. A series of paper and pencil tests developed to examine these relationships was administered to eight design engineers during two four-hour sessions. Design characteristics significantly related to skill level are test points, internal components, checkout and troubleshooting procedures, type of test equipment required and go/no-go displays. Individual design concepts such as component repair are also significiantly related to the amount of training required. The engineer conceptualizes maintenance skill in terms of knowledge, troubleshooting ability and flexibility. The engineer's concept of skill level is more performance-oriented than that described by Air Force Specialty Code designations. Skill level appears not to be related in the engineer's mind to years of experience. (76 pp.)

62 **Highcove, J.E., Kibbee, J.M., Stout, R., & Dominguez, L.F. Base engineer automated management system (BEAMS): training at Sheppard Technical Training Center. AFHRL-TR-69-24, AD-702 866. Wright-Patterson AFB, OH: Training Research Division, December 1969. Project 686F, Contract F33615-68-C-1076, Technical Communications, Inc. NTIS.** Instructional materials including plans of instruction, student workbooks, instruction guides, and simulated automated transactions were developed for use with hardware and software in courses of instruction designed to teach Air Force personnel to operate, maintain and utilize the base engineer automated management system (BEAMS). When supported by the necessary instructional materials for integrating them into organized instructional activities, simulations provide effective training systems. (52 pp.)

63 **Vickman, L., Harmon, L.R., Stout, R., Dominguez, L.F., & Stellmach, A.T. Base engineer automated management system (BEAMS): education at the civil engineering school. AFHRL-TR-69-25, AD-702 516. Wright-Patterson AFB, OH: Training Research Division, November 1969. Project 686F, Contract F33615-68-C-1076, Technical Communications, Inc. NTIS.** Concurrent with the development of the Base Engineer Automated Management System (BEAMS), plans were developed for the education of Civil Engineer Management level personnel at the Air Force Institute of Technology (AFIT) in the operation and use of this new system. As an integral part of this education, a computer simulation was developed to provide the students with hands-on training and experience with BEAMS. The development of this simulation paralleled the development of BEAMS itself, and

required modification on several occasions as BEAMS was altered in its development. The final version of the simulation was based on the October 1968 version of BEAMS and in March 1969 replaced prototypes which had previously been in operation at AFIT. The simulation was designed to create the conditions, atmosphere and operational situations that would be prevalent at a typical Air Force base operating under the BEAMS concept. It was designed to take place over a period of one week and to encompass most of the activity which might reasonably be expected to occur in Civil Engineering organizations at bases anywhere in the world. AFIT students were required as a part of their simulation training to use a remote terminal keyboard/printer to perform various clerical processes required by the simulation. The purpose of this participation was to increase their knowledge and understanding of BEAMS, and to add to their motivation and enthusiasm in the implementation and use of the system. (39 pp.)

64 **Morsh, J.E., & Nall, R.W. Job survey of special operations officers and airmen. AFHRL-TR-69-26, AD-A007 054. Lackland AFB, TX: Personnel Research Division, October 1969. Project 7734. NTIS.** At the request of the Office of the Chief of Staff, HQ USAF, this study was undertaken to identify special operations (SO) activities performed by Air Force personnel. This information is needed for management decisions related to attendance, course schedules, and content of training courses for the USAF Special Operations School. Officer and airman job inventories were constructed to include work tasks related to psychological operations, civic actions, counterinsurgency, and unconventional warfare. These inventories were administered to all personnel identified by commands as performing SO activities. Complete returns were obtained from 404 officers and 189 airmen, most of whom reported spending only part time on SO tasks. Accepting the sample as being reasonably complete, one must conclude that SO is a relatively small Air Force enterprise at the present time. The study includes an analysis of SO job types and ratings of the extent of need on the job of certain courses and educational topics related to SO. (74 pp.)

65 **Mayo, C.C. Construction and administration of ten Air Force job inventories. AFHRL-TR-69-27, AD-700 745. Lackland AFB, TX: Personnel Research Division, October 1969. Project 7734, Contract F41609-68-C-0016, Lifson, Wilson, Ferguson, and Winick, Inc. NTIS.** Ten job inventories were constructed for survey of 11 Air Force career ladders. Background variables designed to assess task-related information were included in each inventory. A replication of a previous study of contributions of technical advisers to inventory construction supported the earlier finding that airmen at supervisory skill levels provide the best job information. Broad statements to work designed to discriminate between job types on a more global level than task statements were included in eight job inventories. Trial answer sheets designed to be scored by optical scanning devices were administered on two surveys. Inventory constructors predicted job types for all career ladders surveyed. Write-in information from administrative surveys was reviewed, and significant contributions were added to job inventory content. Inventory responses were keypunched and verified in preparation for electronic data processing. (24 pp.)

66 **Kibbee, J.M., Highcove, J.E., Harmon, L.R., Dominguez, L.F., & Stellmach, A.T. An education and training simulation of the USAF base engineer automated management system. AFHRL-TR-69-28, AD-702 122. Wright-Patterson AFB, OH: Training Research Division, October 1969. Project 686F, Contract F33615-68-C-1076, Technical Communications, Inc. NTIS.** As part of an overall education and training program to instruct Air Force Base Civil Engineering personnel in the concepts and use of the Base Engineer Automated Management System (BEAMS), a simulation of the system was developed. This simulation, designated SIMA, covers a period of one week at a hypothetical Air Force Base, Hardnose AFB, and is intended to give the students an understanding of, and experience in, using BEAMS as part of their day-to-day activities at their bases. The simulation consists of a data base for Hardnose AFB, and a series of transactions that update the data base; the sequence and interdependency of the various transactions are described in an accompanying scenario. Because the

simulation was specified for use in a number of different courses, oriented toward both management education and technician training, it was designed to be independent and self-contained, as well as modular. It can thus be easily adapted to any of the courses. (36 pp.)

67 **Faconti, V., Mortimer, C.P.L., & Simpson, D.W. Automated instruction and performance monitoring in flight simulator training. AFHRL-TR-69-29, AD-704 120. Wright-Patterson AFB, OH: Training Research Division, February 1970. Project 6114, Contract F33615-69-C-1159, Singer-General Precision Systems, Inc. NTIS.** This report documents research in the area of Automated Instruction and Performance Monitoring. One objective of the research was to develop modular approaches to implementing eight individual automated training capabilities in flight simulators. Several approaches to each area are identified and briefly investigated. More complete investigation, including programming flow diagrams and hardware and software estimates, is presented on those approaches in each capability area which appeared to be most feasible. Two integrated systems, i.e., systems which include all eight automated training capabilities, are "designed." Selection of the components for each of the systems is made by assigning levels of relative complexity to each approach in each area. System one is designed by using the lowest complexity approach in each area while system two consists of the highest. Several methods of implementation, in relation to the computer complex, are presented. These varied from including the instructional system in the basic simulation programs to the addition of satellite computers to handle the instructional function. Estimated implementation costs are given for the two systems for each selected computer configuration and two display system options. (365 pp.)

68 **Rhode, W.E., Esseff, P.J., Pusin, C.J., Quirk, F.B., & Shulik, R. Analysis and approach to the development of an advanced multimedia instructional system. AFHRL-TR-69-30(I), AD-715 329. Wright-Patterson AFB, OH: Training Research Division, May 1970. Project 686F, Contract F33615-69-C-1728, Westinghouse Learning Corp. NTIS.** In order to examine the possibilities for an advanced multimedia instructional system, this study begins with a comprehensive review and assessment of current instructional media in terms of (1) a functional description, (2) instructional flexibility, (3) support requirements, and (4) costs. Following this, a model of an individual instructional system is developed as a basis for further analysis. Final comparisons and "trade-offs" among the media are then made to arrive at a recommended media configuration which could serve as a multimedia base for an individualized instructional system. At this point, requirements and features of an automated management information and control subsystem to provide necessary operational control of the total instructional system are outlined and discussed. Finally, the main features of a generalized plan for the development of such a system are described. (434 pp.)

69 **Rhode, W.E., Esseff, P.J., Pusin, C.J., Quirk, F.B., & Shulik, R. Analysis and approach to the development of an advanced multimedia instructional system (appendix III – media cost data). AFHRL-TR-69-30(II), AD-715 330. Wright-Patterson AFB, OH: Training Research Division, May 1970. Project 686F, Contract F33615-69-C-1728, Westinghouse Learning Corp. NTIS.** In order to examine the possibilities for an advanced multimedia instructional system, this study begins with a comprehensive review and assessment of current instructional media in terms of (1) a functional description, (2) instructional flexibility, (3) support requirements, and (4) costs. Following this, a model of an individual instructional system is developed as a basis for further analysis. Final comparisons and "trade-offs" among the media are then made to arrive at a recommended media configuration which could serve as a multimedia base for an individualized instructional system. At this point, requirements and features of an automated management information and control subsystem to provide necessary operational control of the total instructional system are outlined and discussed. Finally, the main features of a generalized plan for the development of such a system are described. (292 pp.)

70 **Schumacher, S.P., Rudov, M.H., & Valverde, H.H. Evaluation of a low cost in-flight audio/video recording system for pilot training. AFHRL-TR-69-31, AD-709 213. Wright-Patterson AFB, OH: Training Research Division, January 1970. Project 686F, Contract F33615-68-C-1048, American Institutes for Research. NTIS.** This report describes a study to determine the feasibility and effectiveness of using in-flight audio/video recording and ground playback equipment in the United States Air Force Undergraduate Pilot Training (UPT) Program. It includes a detailed description of a low cost Audio/Video Recording System (AVRS) which was developed for the study. Audio/Video equipment configurations are discussed as they apply to training operations in the T-37 aircraft. A description is given of the training methodology which was formulated for integrating the audio/video recordings of student maneuvers into flight training program. Airborne cameras were used to view the flight instruments and the pilot's forward outside scene. The operational use of the AVRS is described for two on going classes of pilots. Each class was comprised of two matched groups of students, one of which was trained with AVRS (TV students), and one of which was trained in the normal manner. The results in terms of differences in achievement levels and learning rates for the TV and non-TV students are described. Conclusions as to high equipment reliability and easy maintainability and the training benefits which can be expected to accrue from use of the AVRS are detailed. Finally, recommendations are presented for the improvement and implementation of the AVRS as an instructional tool. (174 pp.)

71 **Mayo, C.C. Three studies of job inventory procedures: selecting duty categories, interviewing, and sampling. AFHRL-TR-69-32, AD-700 746. Lackland AFB, TX: Personnel Research Division, November 1969. Project 7734, Contract F41609-68-C-0016, Lifson, Wilson, Ferguson, and Winick, Inc. NTIS.** Three United States Air Force job inventory procedures were studied in depth: categorizing task statements by duties, interviewing technical advisers for job information, and detecting bias in survey samples. Variations in the usual grouping of supervisory tasks were found to be occasionally necessary. Depending upon the career ladder surveyed, non-supervisory tasks are best organized by work section, by function, or by equipment format. Criteria are suggested for determining the point at which interviews become more productive than publications research. Interviewing is more effective when advisers are chosen according to experience, rank, kind of organization to which assigned, and job type. An analysis of trends in ten survey samples showed few unexplainable underrepresentations. (9 pp.)

72 **Shenk, F. Career indications among junior officers. AFHRL-TR-69-33, AD-703 728. Lackland AFB, TX: Personnel Research Division, September 1969. Project 7719. NTIS.** A historical study of officer input from the principal Air Force commissioning programs was initiated in 1963. This study was designed to determine the predictability of an Air Force officer's career decision and to evaluate relationships between career intent and various demographic, environmental, and attitudinal factors. Information on this group has been compiled for the period prior to commissioning and through three years of active duty. A final analysis will be made with the ultimate criterion of "in *vs.* out of service." This report presents a description of the study and results from a preliminary examination of the data. Based on the expressed career intent, the most favorable sources for retention were found to be OCS and OTS-AECP; officers from both of these sources have had prior service experience. The yearly responses to the career-intent statement indicated a decline in career intent at least through the first few years of military service. Job characteristic factors considered important and attainable were also examined. Factors considered most important centered around job satisfaction such as working under competent supervisors, having a sense of accomplishment, and having an opportunity for advancement. Least important values were represented by such factors as early retirement, travel, and having a definite work schedule. In general, the perceived importance of a reward or working condition in the Air Force showed little relationship to the perceived possibility of achieving that factor. In fact, the greater the discrepancy between the importance and possibility of given factors, the more likely a subject was to have an unfavorable attitude. (12 pp.)

73 **Hansen, O.K., Wright, M.E., & Wood, M.E. Airborne operator target recognition training procedures: experimental plan for visual reconnaissance study. AFHRL-TR-69-34(I), AD-873 193. Wright-Patterson AFB, OH: Training Research Division, May 1970. Project 665A, Contract F33615-67-C-1945, North American Rockwell Corp. DDC.** The results of the first phase of the Airborne Operator Target Recognition Training Procedures study are presented. The objective of this phase has been to develop alternative training procedures for visual reconnaissance observers and to develop a plan for experimental comparison and evaluation of the procedures. Four major interdependent analyses were conducted. One analysis provided a definition of representative aerial observer activities collectively referred to as the criterion task. Another study was concerned with the selection and preparation of training films. A third study area involved the development of specific training procedures, and the fourth study concerned the development of methods and instruments for measurement of trainee performance. The joint output of these analyses was finally integrated into a formal experimental design and a plan for training evaluation. The next phase of the program will involve two experiments, one to exercise the plan described herein and another to evaluate a similar set of training procedures for side looking radar (SLR) operators. (90 pp.)

74 **Hansen, O.K. Airborne operator target recognition training procedures: visual reconnaissance study. AFHRL-TR-69-34(II), AD-874 810. Wright-Patterson AFB, OH: Training Research Division, July 1970. Project 665A, Contract F33615-67-C-1945, North American Rockwell Corp. DDC.** The results of the second phase of the Airborne Operator Target Recognition Training Program are presented. The purpose of this phase was to conduct an experimental evaluation of alternative training procedures designed to develop the target recognition skills of airborne observers.

The study employed a semi-automated training system and a visual flight simulator for final test comparisons. Experimental subjects were selected from a college student population having the physical, biographical, and psychological characteristics of USAF flight trainees.

Results of the study were interpreted in three contexts. One related to the formal data interpretation. Another related to the practical problems of training military personnel in tactical target recognition and the third context related to training research methodology. It was concluded that the most effective training program was the one that included the psychophysiological vision material in combination with the instruction on specific target signatures and narrow-field static search. It was also concluded that new methods are needed to incorporate practical military considerations such as training cost, personnel availability, and operational relevance into the research decision strategy. Some of these considerations were explored and a list of practical training research limitations was formulated. (90 pp.)

75 **Mayo, C.C. A method for determining job types for low aptitude airmen. AFHRL-TR-69-35, AD-700 747. Lackland AFB, TX: Personnel Research Division, November 1969. Project 7734, Contract F41609-68-C-0016, Lifson, Wilson, Ferguson, and Winick, Inc. NTIS.** An opinion survey method for identifying low aptitude job types was developed and used in a study of 11 Air Force career ladders. Lists of low aptitude tasks were defined by technical advisers. These tasks were then rated on nine factors by Air Force instructors who also described low aptitude job types and gave their opinion concerning the possibilities for advancement and training of low aptitude personnel. In an evaluation of the research methodology, strengths and weaknesses of the opinion survey method were delineated. The relative ease with which the tasks lists were constructed lent support to the utility of the method. A limitation in the method was recognized in the inability to control for systematic rater bias. (9 pp.)

76 **Morsh, J.E. Survey of Air Force officer management activities and evaluation of professional military education requirements. AFHRL-TR-69-38, AD-705 574. Lackland AFB, TX: Personnel Research Division; December 1969. Project 7734. NTIS.** The main purpose of the officer management survey was to identify functions which all officers perform as distinct from work

specific to a particular specialty and to determine the relationships of managerial responsibility to grade, career area, or other variables. A further aim was to obtain an evaluation of topics of professional military education requirements in terms of job performance or as contributory to an effective Air Force career. The world-wide survey sample consisted of 10,242 Air Force officers in grades second lieutenant through colonel. An officer management inventory was administered in 19 major commands using conventional sample survey procedures through the cooperation of the Data Application Division, Data Services Center, Headquarters USAF. In the subsequent analysis by means of the Personnel Research Division job-clustering program, management job types were not clearly differentiated. The extent of managerial responsibility, however, was shown to be directly related to grade. Field-grade officers performed, on the average, approximately four times as many managerial tasks as company-grade officers. Consolidated descriptions of management tasks performed were published for staff, field-grade, and company-grade officers in each of nine career areas. While some differences in emphasis were found, officers in the several career areas tended to allocate more or less the same percentage of their jobs to tasks falling in each of the management categories. Group difference descriptions were computed to highlight some of the major career ladder managerial differences. In evaluating 128 professional military education requirements topics, officers of all grades indicated a substantial need on the job for principles and techniques of leadership; oral and written communication; techniques of logical and of creative thinking; problem solving procedures; officer ethics; discipline and morale; military customs, courtesies, and ceremonies; and security of classified military documents and equipment. (86 pp.)

77 **Morsh, J.E., & Nall, R.W. Occupational survey of the electronic computer repairman career ladder 305X3. AFHRL-TR-69-39(I, II), AD-720 952. Lackland AFB, TX: Personnel Research Division, November 1969. Project 7734. NTIS.** A job inventory covering four specialties in the Electronic Computer Repairman Career Ladder, and consisting of 340 tasks grouped under 16 duty categories, was administered to 1,087 airmen in 10 major commands. Incumbents of all skill levels completed a background information section and rated on a 7-point scale relative time spent on tasks. The airmen also indicated on a 7-point scale the extent to which tasks were learned in technical school as compared with on the job. Job descriptions are presented for 53 groups selected according to background information variables. Included are 4 DAFSC groups, 6 job type clusters, 42 significant job types identified by the automated job clustering program, and the Electronic Computer Repairman Career Ladder Total Sample.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected groups. Distributions of background variables for the total sample, clusters, job types, and for the four DAFSC groups are also shown.

Technical report numbers 69-40 through 69-100 were not assigned.

78 **Koplyay, J.B. Field test of the weighted airman promotion system: phase I. analysis of the promotion board component in the weighted factors system. AFHRL-TR-69-101, AD-689 751. Lackland AFB, TX: Personnel Research Division, April 1969. Project 6323. NTIS.** For the purposes of field testing the proposed Weighted Airman Promotion System, the Alaskan Air Command supplied data on 2,835 airmen eligible for promotion to grades E-4 through E-7 in the FY 69-2 promotion cycle. Data included scores on the Specialty Knowledge Test and the Promotion Fitness Examination; points credited for time in grade, time in service, decorations, and Airman Performance Report mean overall evaluation; and ID information. Cases for which test scores were unavailable were eliminated; the final sample consisted of 2,290 airmen, 81 percent of the original eligibles.

Average promotion board scores were computed by dividing each airman's raw board score by the number of members on the promotion board and multiplying the quotient by 10. Weighted factors scores were computed by adding the factor scores. Two such total composite scores were

obtained: a weighted factors score excluding the average board score and a weighted factors score including the average board score. The analyses concentrated on the comparisons of these two total composite scores. The hypothesis tested was that inclusion of the board score component in the weighted factors composite score does not have an effect on the ranking of the airmen. Ranks on the composite total scores with and without the board score were analyzed for strength of relationship. Average board scores were analyzed for differences in scoring across Air Force Bases and by different size board panels.

The following results were obtained: (a) There were significant differences in average board score means between Elmendorf and Eielson AFBs for grade E-3 personnel. (b) There were significant differences in average board score means between 3-member and 5-member board panels. (c) There was a very high, near perfect relationship between weighted factors composites excluding and including the board score component. (d) Rankings of individuals on the weighted factors composite were essentially unaffected by inclusion of the promotion board score.

Since inclusion of a board score component had a negligible effect on the ranking by composite total score, and since means of board scores differed between bases and between boards with different panel sizes, it was concluded that including a board score factor merely inserted a non-visible component which would obscure explanations for non-promotion. (13 pp.)

79 **Korjyay, J.B. Field test of the weighted airman promotion system: phase II. validation of the system for grades E-4 through E-7. AFHRL-TR-69-102, AD-697 798. Lackland AFB, TX: Personnel Research Division, May 1969. Project 6323. NTIS.** A weighted factors promotion system was field-tested and validated using data from the FY 69-B promotion cycle of the Alaskan Air Command. The final sample included 2,290 promotion-eligible airmen in grades E-3 through E-6. The weighted factors composite score excluding a promotion board component gave airmen the same relative rank within selected Air Force Specialties as did the promotion board evaluations under the present operational system. Overlaps between the two ranks imply promotion of the same individuals by both systems. However, inconsistencies and unexplainable discrepancies in the ranking by promotion board scores were found in some few instances. It was concluded that, within the specialties analyzed, practically all the individuals promoted by the board system would also have been promoted under the weighted factors system. If it can be assumed that the sample was representative of the Air Force-wide population of promotion-eligible airmen in grades E-3 through E-6, then it can be further assumed that the weighted factors system provides a valid airman promotion system in which the selection criteria are visible and equitable. (11 pp.)

80 **Miller, R.E. Interpretation and utilization of scores on the Air Force Officer Qualifying Test. AFHRL-TR-69-103, AD-691 001. Lackland AFB, TX: Personnel Research Division, May 1969. Project 7717. NTIS.** This report summarizes a large body of data relevant to the proper interpretation and use of aptitude scores on the Air Force Officer Qualifying Test. Included are descriptions of the AFOQT testing program and the general characteristics of the test itself. Technical concepts are introduced by a brief explanation to assist users of AFOQT scores who are not test specialists. Technical data include an extensive sampling of validation studies covering prediction of success in pilot training, navigator training, technical training, and academic courses. Relationships to other well known tests and the Air Force structure of career areas and utilization fields are indicated. Several types of reliability data are presented, together with intercorrelations of the aptitude composites both with and without the elevating effects of overlapping subtests. The Air Force percentile scoring system is discussed in relation to the normal probability curve and the stanine scale. Score distributions are provided for officers, candidates for programs leading to a commission, basic airmen, and 12th grade males. Procedures used in standardizing new forms of the AFOQT through the Project TALENT aptitude composites are described, including operations which maintain relationships with Air Force Academy candidates and the TALENT national sample. Effects of applying minimum qualifying scores and adjustments for level of formal education at the time of testing are explained. (29 pp.)

81 **Ratliff, F.R., Shore, C.W., Chiorini, J.R., & Curran, C.R. Inflight performance differences of pilot and navigator F-4 second-seat crewmembers: a limited Southeast Asia combat evaluation. AFHRL-TR-69-104, AD-705 140. Lackland AFB, TX: Personnel Research Division, July 1969. Project 6323. NTIS.** A task inventory was administered to F-4 crewmembers following each of a series of combat missions. The inventory was one of several data collection instruments developed as part of Project Combat Team to gather behavioral data designed to relate the differences in training of pilots and navigators to operational performance. The traditional task inventory technique was modified in the following manner: (a) the checklist contained only 30 tasks; (b) the tasks were presented in chronological order; (c) a background information section was included to identify important mission variables; and (d) the task inventory was repeatedly administered to all test subjects, once after each mission. Frequency of task performance, average time spent, group overlap, and hierarchical grouping analyses were made. A longitudinal analysis of average time spent was also performed. Data from other instruments developed as part of Project Combat Team relevant to the circumstances in which the second-seat crewmembers handled the flight controls were also presented. Several conclusions were drawn on the basis of these data: (a) reliable and valid aircrew performance data can be gathered in the combat setting using a task inventory; (b) traditional task inventories can be modified to provide measures of the effects of training differences on combat performance; (c) pilot and navigator second-seaters apparently were similar in the performance of second-seat duties, and their aeronautical rating had little effect on the performance of their aircraft commanders; and (d) data from several types of instruments covering different aspects of job performance can be integrated to provide data to management for use in operational manning decisions and evaluation of training programs. (27 pp.)

82 **Morsh, J.E., & Nall, R.W. Occupational survey of the helicopter mechanic career ladder 431X0. AFHRL-TR-69-105(I, II), AD-689 180 and AD-689 181. Lackland AFB, TX: Personnel Research Division, March 1969. Project 7734. NTIS.** A job inventory covering four specialties and related shredouts in the Helicopter Mechanic Career Ladder and consisting of 368 tasks grouped under 14 duty categories, was administered to 913 airmen in 13 major air commands. Incumbents of all skill levels completed a background information section and rated on a 7-point scale relative time spent on tasks. The airmen also indicated on a 7-point scale amount of work experience on each task compared with other tasks performed. Job descriptions are presented for 37 groups. Included are 10 DAFSC groups, 6 job type clusters, 20 significant job types identified by the automated job clustering program, and the Helicopter Mechanic Career Ladder total sample.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected groups. Distributions of background variables for the total sample and for the DAFSC groups are also shown.

83 **Garza, A.T. Occupational survey of the radiology career ladder 903X0. AFHRL-TR-69-106, AD-705 176. Lackland AFB, TX: Personnel Research Division, March 1969. Project 7734. NTIS.** A job inventory covering four specialties in the Radiology Career Ladder, and consisting of 369 tasks grouped under 15 duty categories, was administered to 576 airmen in 16 major air commands. Incumbents of all skill levels completed a background information section and the relative time spent on tasks rated on a 7-point scale. The airmen also indicated on a 7-point scale the source of training for each task performed. Job descriptions derived by electronic computer are presented for four specialty groups, four job-type clusters, eleven significant job types, and for the total sample of the Radiology Career Ladder. Narrative summaries are presented for the clusters and job types identified by the automated job-clustering program.

Two group overlap matrices show the similarity of groups in terms of time spent on tasks. Summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for selected groups. Distributions of background variables for the total sample, four specialty groups, clusters and job types are also shown.

The considerable amount of homogeneity of the work performed by the members of the Radiology Career Ladder would appear to minimize the training and assignment problems which affect the more heterogeneous career ladders. All of the members in this ladder perform a large body of common work activities; the differences are primarily those which are the result of specialized job functions.

84 **Pieper, W.J., Swezey, R.W., & Valverde, H.H. Learner-centered instruction (LCI): evaluation of the LCI approach. AFHRL-TR-70-1(VII), AD-713 111. Wright-Patterson AFB, OH: Training Research Division, February 1970. Project 686F, Contract F33615-68-C-1692, Applied Science Associates, Inc. NTIS.** The evaluation of the Learner Centered Instruction (LCI) approach to training was conducted by comparing the LCI F-111A Weapons Control System Mechanic/Technician course with the conventional Air Force course (ABR 32231R) for the same Air Force Specialty Code (AFSC) 32231R on the following dimensions: (1) job performance of course graduates, (2) man-hour and dollar costs of the two courses, and (3) student acceptability and instructor problems for the LCI course. Measures of job performance included a job performance test, an Air Force practical test, the supervisors' ratings, and a substitute job knowledge test. The graduates were measured both at end-of-course and again after five months in the field at field followup. The high aptitude LCI trainees' job performance was superior to the high aptitude conventional course trainees. Costs in terms of man-hours and dollars for the LCI course were substantially lower than those for the conventional course. The LCI course was about equally acceptable to the high and medium aptitude trainees but some of the instructors had misgivings about the LCI approach. This report includes implications of integrating LCI courses into the Air Force training environment. (147 pp.)

85 **Koplyay, J.B. Extension of the weighted airman promotion system to grades E-8 and E-9. AFHRL-TR-70-2, AD-703 687. Lackland AFB, TX: Personnel Research Division, January 1970. Project 6323. NTIS.** The Weighted Airman Promotion System (WAPS), a system designed and implemented for E-4 through E-7 promotions, was considered for application at the E-8 and E-9 levels. A sample of 1,388 cases was selected from among airmen eligible for promotion to E-8 in the FY 1969 promotion cycle; four career fields in each of four selector aptitude areas were represented. Weighted factors composite scores, including United States Air Force Supervisory Examination, Time-in-Grade, Time-in-Service, Decoration, and Airman Performance Report scores, were computed for all cases in the sample. These composite scores were computed both with and without a Promotion Board score. The derived scores were then rank-ordered to determine the accuracy with which the composite scores predicted the actual promotion outcomes. Although there was some overlap between the predicted and actual promotions, the predictions were not precise enough to encourage operational use of the system with the weights as established in the WAPS. In a series of regression analyses, optimal weights were computed for the same factors. Again, however, the predicted promotions did not correspond sufficiently with the actual promotions to demonstrate feasibility of the system. Further, there was evidence that differential promotion policies were operating in the promotion decisions across career fields. It was concluded, therefore, that a weighted factors promotion system appropriate for use at the E-8 and E-9 levels must include as yet unidentified variables and possibly different equations for various career fields. (12 pp.)

86 **Grunzke, M.E., Guinn, N., & Stauffer, G.F. Comparative performance of new ability airmen. AFHRL-TR-70-4, AD-705 575. Lackland AFB, TX: Personnel Research Division, January 1970. Project 7719. NTIS.** The military accessions program "Project 100,000," established in 1966, has as one of its goals enlistment in the military services of a yearly minimum of 100,000 men who have previously been declared ineligible for military service because of failure to meet required mental or,

in some cases, physical standards. This study was conducted to evaluate the progress of these marginal ability personnel who enlisted in the United States Air Force. Data were collected on their performance in training and during assignment to jobs throughout the Air Force. The analysis revealed that their adaptability to the Air Force and job performance was at a lower level than that of the control subjects. (21 pp.)

87 **Valverde, H.H., & Roberts, R.E. A responder for use in programmed lectures. AFHRL-TR-70-5, AD-708 504. Wright-Patterson AFB, OH: Training Research Division, May 1970. Project 1710. NTIS.** This report describes the student responder and presents information as to how the device may be used to obtain student responses during programmed instruction lectures. In Air Force flying and technical training programs, the device can be especially useful in lecture/slide presentations designed to teach need-to-know information. Unlike any other responders, this device can be used in a dimly lit or darkened classroom during slide presentation; when multiple-choice questions are projected on the screen, the student responses are illuminated and thus can be seen clearly by the instructor. The parts required to build the responder are identified and the prices of the parts listed, and a step-by-step procedure for constructing the device is presented. (12 pp.)

88 **Potempa, K.W., Talcott, D.R., Loy, S.L., & Schwartz, N. Videotape as a tool for improving human factors test and evaluation activities. AFHRL-TR-70-6, AD-708 505. Wright-Patterson AFB, OH: Training Research Division, May 1970. Project 1124. NTIS.** Analysis of the literature has indicated that fairly unsophisticated methods are generally used to collect human factors test and evaluation data in the field. The most commonly used methods being direct observation, interview, and questionnaires. One technique which is being looked at to expand our capabilities is video tape recordings. The use of this technique to collect data on both maintenance and aircrew performance is being examined. The videotape equipment being used to study aircrew performance was custom made in order to fit the unique requirements of flight environment. The utility of this system for collecting human factors test data is currently being evaluated in the F-4E Category II test program at Edwards AFB. The data obtained from the videotapes on pilot activity is being compared with that obtained from pilot interviews in terms of accuracy of information, kinds of information each method is best suited to provide, and the number and kinds of human factors decisions which each technique best facilitates. In addition, methods of integrating the use of both methods in field tests are being studied. The TV equipment used in collecting maintenance data consisted of standard commercial items but a number of packaging innovations were made to increase their portability. This study, which also used the F-4E as a test bed, pointed up many of the advantages and limitations of videotape as a data collection tool. (12 pp.)

89 **Taylor, J.N., & Valentine, D.E. Graduate education of Air Force line officers. AFHRL-TR-70-7, AD-707 510. Lackland AFB, TX: Personnel Research Division, January 1970. Project 6323. NTIS.** This study was undertaken to provide a quantitative description of the graduate degree holders within the Air Force line officer force. Line officers holding graduate degrees who were on active duty between 1961 and 1968 comprised the research population. The basic data source was the Uniform Officer Record and the UOR Reformat, a historical research file maintained by the Personnel Research Division. Records of officers on active duty as of 30 June 1968 were examined to determine how and when they obtained their degrees and the academic specialties and degree levels involved. The population was also examined at different points in time during the period 1961 through 1967 to determine distributions and growth rates among the various duty occupational groups. Retention rates for line officers with graduate degrees were obtained and compared with retention rates for all line officers during the period 1961 through 1967. Information reflecting the distribution by rank of the graduate degree holders in the line officer force for the years 1961 and 1968 was also included. (21 pp.)

90 **Askren, W.B., & Valentine, R.I. Value of job experience to teaching effectiveness of technical training instructors. AFHRL-TR-70-8, AD-709 876. Wright-Patterson AFB, OH: Training Research Division, June 1970. Project 1710. NTIS.** Air Force Technical training instructors with and without field job experience were compared regarding teaching effectiveness. Effectiveness was measured by student grades, student written critiques, and supervisor ratings. Results indicate no significant difference between instructors on student overall course grades and critiques. However, an interaction effect exists between type of instructor and phase of course. Supervisors rate job-experienced instructors higher. (14 pp.)

91 **Shore, C.W., Curran, C.R., Ratliff, R.G., & Chiorini, J.R. Proficiency differences of pilot and navigator F-4 second-seat crewmembers: a Southeast Asia evaluation. AFHRL-TR-70-9, AD-709 728. Lackland AFB, TX: Personnel Research Division, April 1970. Project 6323. NTIS.** A proficiency rating form was administered to F-4 crewmembers following each of a series of combat missions. The rating form was one of several data collection instruments developed as part of Project Combat Team to gather behavioral data designed to relate the differences in the training of pilots and navigators to operational performance. The rating categories were designed to measure proficiency in ten second-seater functions and three general characteristics related to second-seater proficiency. Using an 11-point rating scale, aircraft commanders compared their second-seat crewmember with second-seaters of equal combat experience. Differences between pilot and navigator second-seaters on each rating category were tested by a multiple linear regression analysis. Data from other instruments relevant to evaluation of mission success were also presented. Several conclusions were drawn on the basis of these data: (*a*) It is possible to obtain reliable, valid proficiency data in a combat environment. (*b*) Proficiency ratings can be used to measure the performance differences between two groups in an operational setting. (*c*) By the 30th mission neither group of second-seaters demonstrated a general superiority in performance over the other. (Differences between pilots and navigators early in their combat experience were sharply reduced by mission segment 26 to 30, except in performance of the task Understanding Radio Communications.) (*d*) The early proficiency differences between pilot and navigator second-seaters appeared to be a function of training differences. Therefore, it may be possible to reduce or eliminate these differences through modifications in crew training programs. (*e*) During the first 30 combat missions, pilots flew on more missions rated as completely successful than did navigators. Although the differences were small, they were statistically significant. (19 pp.)

92 **Hoggatt, R.S., & Hazel, J.T. Reliability of individual versus group job pay ratings. AFHRL-TR-70-10, AD-708 724. Lackland AFB, TX: Personnel Research Division, May 1970. Project 7734. NTIS.** This study investigated two approaches for obtaining job ratings in order to determine which procedure provided the most stable ratings, given a constant number of raters. Specifically, it compared reliability estimates determined by averaging across individually obtained job ratings and reliability estimates based on consensus ratings from interacting panels. To investigate reliability of job ratings obtained from individuals and from groups or panels of raters, 450 basic airmen rated 100 brief job descriptions under three conditions; (*a*) individually, (*b*) in a 3-man panel, and (*c*) in a 5-man panel. Analyses revealed that estimates of mean reliability were larger for individually obtained ratings than for 3-man or 5-man panel ratings. There was also a trend for mean rating time to increase with an increase in panel size. Present findings tend to support the procedure of averaging across individual ratings, rather than the use of ratings from panels, in order to obtain more stable results. In terms of reliability, time required, and number of raters, the individual approach appears more economical and efficient than the board or panel procedure. (18 pp.)

93 **Phalen, W.J. Occupational survey of the data systems career field (68XX0). AFHRL-TR-70-11, AD-706 112. Lackland AFB, TX: Personnel Research Division, May 1970. Project 7734. NTIS.** A job inventory covering 15 specialties in the Data Systems career field, and consisting of 511 tasks grouped under 14 duty categories, was administered to 4865 airmen in 19 major air commands, from which

4762 usable cases were obtained. A subsample of 1622 cases was selected for processing by the automated job clustering program, and an additional 229 cases from the Data Services (681X0) career ladder were added to this subsample and the automated job clustering reperformed. Incumbents of all skill levels completed a background information section and rated on a 7-point scale relative time spent on tasks. The airmen also indicated on a 7-point scale how they received their training in the tasks performed. Job descriptions are presented for 20 "special" groups selected according to background information variables. Included are the DAFSC and total sample groups for each career ladder. Duty and task descriptions are presented for the total Data Systems (68XX0) subsample of 1622 cases, for 7 major job-type clusters, for 9 job-type subclusters, and for 58 significant job types identified by the automated job clustering program.

A group overlap matrix shows the similarity of groups in terms of time spent on tasks. Group summary tables indicate the percentage of members in each group who perform each task. Group difference descriptions are given for various pairs of DAFSC groups. Distributions of background variables for the total subsample of 1622 cases, the 7 major job-type clusters, and the 9 job-type subclusters are also shown. Also included are distributions of background variables for the 15 specialty groups and the total group surveyed (N = 4762). Responses to items in the background information section are presented for every case in the survey. The complete inventory of duties and tasks used in the survey is also included.

94 **Fligor, P.D. Analysis of data density and storage requirements for high resolution radar simulation system design. AFHRL-TR-70-12, AD-711 385. Wright-Patterson AFB, OH: Training Research Division, June 1970. Project 6114, Contract F33615-69-C-1363, Technology Incorporated. NTIS.** The state-of-the-art was sampled to determine whether modern, commercially available computers with mass data storage units offered the potential for simulation of the performance of high-resolution radar systems. This effort was primarily concerned with the data storage for urban areas since such areas would place the severest burden upon the digital storage and computation system. Selected areas of New York City and San Francisco were analyzed from aerial photographs, and 74,000 dimensional readings were taken to form the basis for the conclusions given in this report. The analysis of results based upon extrapolations indicated the feasibility of system simulation from the standpoint of data storage and access time of modern computers. (131 pp.)

95 **Valverde, H.H. Innovations in Air Force technical and flying training. AFHRL-TR-70-13, AD-707 511. Wright-Patterson AFB, OH: Training Research Division, June 1970. Project 1710. NTIS.** Two innovations in technical and flying training are described. The first is an application of the systems approach to electronics maintenance training. The systems approach resulted in a fourteen-week course. The conventional course required twenty-four weeks. Graduates of the two courses were compared on various criteria. The systems approach seems to produce a graduate who is better able to perform the operational job; however, they are less proficient on standardized tests of electronics proficiency. The second effort pertains to the development and evaluation of audio/video recordings in undergraduate pilot training. Equipment mounted in the aircraft produced audio/video recordings that were of substantial help to the students when viewed after flight. (28 pp.)

96 **Huff, K.H., & Smith, E.A. Reliability, baseline data, and instructions for the automated readability index. AFHRL-TR-70-14, AD-729 209. Lowry AFB, CO: Technical Training Division, October 1970. Project 1121. NTIS.** The present study was designed to compare the reliability of the Fog Count with that of the Automated Readability Index (ARI), to establish baseline ARI data on Career Development Courses (CDCs), and to provide a set of general instructions for the use of the ARI. Thirty college students were used to collect the Fog Count reliability data. They tabulated a Fog Count for one CDC and returned two weeks later to retabulate the same material to establish test-retest reliability. For the ARI, a typist was employed to tabulate the reliability data and baseline indices on 20 CDCs. A second typist provided data for computation of test-retest reliability for the

ARI, both between and within typists. The results indicated that the Fog Count was very unreliable; coefficients ranged from .49 to .56. Reliability coefficients for the ARI, on the other hand, ranged from .98 to .99+. It was concluded that the ARI offers an extremely reliable and precise tool for establishing the readability of materials. Another advantage of the ARI is reflected in its ease and rapidity of data collection. Baseline ARI scores are reported for 20 CDCs. An appendix containing general instruction for use of the ARI is also included. (9 pp.)

97 **Guinn, N., Tupes, E.C., & Alley, W.E. Demographic differences in aptitude test performance. AFHRL-TR-70-15, AD-710 618. Lackland AFB, TX: Personnel Research Division, May 1970. Project 7719. NTIS.** The joint and independent relationships between aptitude test performance and certain demographic-cultural variables were investigated as well as the relationship between these variables and the aptitude test factor content. Five test batteries were administered to groups of approximately 1,900 subjects each. Multiple linear regression analyses indicated that there were significant interaction effects for six of the selected tests. The relationship between the cultural variables combined and each aptitude test was significant for all tests. Significant net relationships of race, educational level, and geographical area were found with a majority of tests although wide differences were found among aptitude tests in their sensitivity to demographic-cultural influences. With regard to factor content, race appeared to be related to tests in most factor areas, with its highest relationship in the mechanical area. Education had the highest relationships with verbal, numerical, and reasoning factors and the lowest relationships with the mechanical area. No discernible trend with regard to factor content was noted for geographical area. (23 pp.)

98 **Sellman, W.S. Effectiveness of experimental training materials for low ability airmen. AFHRL-TR-70-16, AD-717 712. Lowry AFB, CO: Technical Training Division, June 1970. Project 1121. NTIS.** The present study was designed to determine if modifying career development course (CDC) format throught the simplification of the written materials, the inclusion of more illustrations, and the addition of audio supplementation could improve the CDC as a training device designed to teach basic job information, especially to airmen possessing minimum verbal skills. High, middle, and low aptitude personnel studied three versions of the CDC for the 57130, Fire Protection, career ladder. In brief, the versions included a conventional CDC, a less verbal CDC with more pictorial materials, and a less verbal CDC with more pictorial materials accompanied by a tape recording of information complementary to that contained in the written text of the CDC. Data were collected on learning performance, reading speeds, and attitudes toward the CDCs. The analyses revealed that the modified CDC with the audio supplementation produced significantly increased learning scores. High and middle aptitude groups consistently outperformed the low aptitude groups across all CDCs. (19 pp.)

99 **Burkett, J.R., & Huff, K.H. Survey of Vietnamese air technical training in United States Air Force technical schools. AFHRL-TR-70-17, AD-883 296. Lowry AFB, CO: Technical Training Division, June 1970. Project 1121. DDC.** The major objective of this study was to provide an overview of current practices and problems in training Vietnamese Air Force personnel in a variety of technical specialties. Observation of VNAF classes and interviews with VNAF students and their USAF instructors were conducted at four CONUS Air Training Command technical training centers. It was found that demonstration-performance instruction coupled with "hands-on" practice training aids were most effective with VNAF students. Willingness to ask and respond to questions in class was dependent upon how well the students knew their instructor and their facility with the English language. English comprehension, especially in understanding technical terms, was found to be a significant and widespread problem. Study discussion groups outside of class among the students were found to be important and effective in anchoring concepts presented in class. Implications and recommendations for further research and development include the conduct of followup studies of in-country VNAF technical training, development and evaluation of specially adapted methods of instruction for use with VNAF trainees, and application of peer instruction techniques to VNAF technical training on an experimental basis. (18 pp.)

100 **Tupes, E.C., & Madden, H.L. The 1969 updating of the data file for the AFROTC management control system. AFHRL-TR-70-18, AD-709 729. Lackland AFB, TX: Personnel Research Division, June 1970. Project 7719. NTIS.** This report describes the background and rationale of an AFROTC Management Control System and the expansion and updating through 1969 of the data base upon which a system must depend. A detailed list and description of 40 detachment effectiveness criteria is presented, with distribution data for 25 criterion variables. Effectiveness criterion scores for selected detachments are described, as are quality control tables developed to indicate the relative effectiveness of each detachment on each criterion. Also described is an effectiveness criterion prediction which makes available predicted scores for more than 800 colleges not presently in the AFROTC program. Examples are shown to demonstrate the usefulness of the system in the pre-evaluation of management decisions. (19 pp.)

101 **Smith, E.A., & Caudill, P.P. Selection of rear projection screens for learning carrels. AFHRL-TR-70-19, AD-717 713. Lowry AFB, CO: Technical Training Division, June 1970. Project 1121. NTIS.** The selection of a rear projection screen for a learning carrel should take into account the viewing angle involved. In some carrels, the screens are utilized primarily to present information. In such cases, the viewer can be seated directly in front of the screen, i.e., on the normal axis. In cases where the screen will be viewed only from a very restricted range, a highly directional screen may be employed. Since such a screen disperses light only to a small area (restricted exit pupil), the light is highly concentrated. A relatively small output is required. This condition is usually favorable in terms of operational economics, reliability, heat generation, noise level, and maintainability. In a very real sense, the level of illumination is controlled by the position of the viewer; he moves to obtain the best image. In other carrels, the learning situation requires that the viewer be mobile, that he move from place to place to perform tasks or complete activities. In such cases, it cannot be assumed that the student will view the screen from the most advantageous position in terms of the image; rather, the position will be dictated by the learning task. To facilitate the matching of a requirement with a screen, 21 commercially available screens were evaluated using a goniophotometer. These data are presented in normalized fashion, allowing the user to compare screens in terms of distribution of light. Relative normal axis readings are also presented, as are the 50 percent and 25 percent angles, i.e., the angles at which light falls off to 50 percent and 25 percent. The 25 percent angle is probably the maximum usable for good viewing. (26 pp.)

102 **Meister, D., Finley, D.L., & Thompson, E.A. Relationship between system design, technician training and maintenance job performance on two autopilot subsystems. AFHRL-TR-70-20, AD-739 591. Wright-Patterson AFB, OH: Advanced Systems Division, September 1971. Project 1124, Contract F33615-69-C-1320, Bunker-Ramo Corp. NTIS.** The purpose of the study was to investigate the relationship between system design and training variables and performance of technicians. Over a five month period technicians at two SAC bases were observed in troubleshooting the MG-1 and A42G autopilots. Following each maintenance incident the technician was interviewed. At the conclusion of the study maintenance supervisors ranked and rated all technicians in terms of skill level. Data collectors also rated the major design characteristics of the equipments maintained. These ratings were correlated with indices of technician performance and subjected to multiple regression analysis. Those factors contributing a significant amount to performance were extracted. A subjective report test battery was also developed to determine whether subjects could predict their own performance. Four general factors were found to be primarily responsible for maintenance performance: (1) accessibility to and within the equipment; (2) diagnostic information supplied by prime and test equipment, T.O.'s and checklists; (3) equipment structure; (4) general technician capability for handling test equipment. A residual experience factor was relatively unimportant. (157 pp.)

103 **Miller, R.E. Development and standardization of the Air Force Officer Qualifying Test Form K. AFHRL-TR-70-21, AD-710 602. Lackland AFB, TX: Personnel Research Division, June 1970.**

Project 7717. NTIS. In accordance with the normal biennial replacement cycle, a new form of the Air Force Officer Qualifying Test (AFOQT) was constructed and standardized for implementation in Fiscal Year 1970. This form is designated Form K. It closely resembles its predecessor in type of content, organization, and norming strategy. It yields Pilot, Navigator-Technical, Officer Quality, Verbal, and Quantitative composite scores. Standardization involved utilization of the Project TALENT battery in a way which permits relating AFOQT scores to performance of Air Force Academy candidates and 12th grade males in the original Project TALENT national survey. AFOQT Form K extends the practice initiated with AFOQT-68 by which conversion tables are adjusted for the effects of formal education on raw scores. The Form K scoring manual contains three sets of conversion tables corresponding to less than two years of college, two or more years but not graduation, and graduation from college at the time of testing. Corrections were made in the adjustment of the Pilot composite for educational effects on the basis of operational experience with AFOQT-68 which showed that the adjustment was excessive. A revision of the *AFOQT Manual for Interpretation* was prepared for publication simultaneously with AFOQT Form K. This manual contains AFOQT information which is not peculiar to any one form. The revision includes a more extensive summary of technical data than previous editions and offers a brief explanation of each technical concept introduced. (9 pp.)

104 **Horner, W.R., Radinsky, T.L., & Fitzpatrick. R. The development, test, and evaluation of three pilot performance reference scales. AFHRL-TR-70-22, AD-727 024. Williams AFB, AZ: Flying Training Division, August 1970. Project 1710. Contract F33615-69-C-1366, American Institutes for Research. NTIS.** This report describes the results of a study to develop pilot performance reference scales based upon audio-video recording of in-flight performance of students undergoing T-37 undergraduate pilot training. The study included scale development as well as the test and evaluation of each scale. All the maneuvers contained on the in-flight recordings were analyzed, and constituent performance elements observable on the video replay were identified. Three maneuvers, Final Turn to Landing, Vertical S "A," and Lazy Eight, were selected for the final scaling effort. Ten performance elements each were identified for the Lazy Eight and Vertical S "A" maneuvers, and twelve elements for the Final Turn to Landing. A performance reference scale was developed for each maneuver. Each scale consisted of a series of subscales for rating performance on each of the elements of the maneuver and an additional subscale for rating the overall performance of the maneuver. Although some elements were common to more than one maneuver, the rating scales for these elements were tailored in each case to the maneuver involved. Each subscale consisted of a ten-point rating line (a row of ten boxes) representing the full range of performance from "unsatisfactory" to "excellent" and, beneath, four graded verbalizations describing different levels of performance. No verbalizations were presented, however, with the subscale used for rating overall performance. Final versions of the scales were subjected to a test and evaluation through their utilization by experienced instructor pilots. These pilots assigned levels of performance based upon what they observed on video replays of selected maneuver examples. The results showed the overall reliability of scales for the three maneuvers was high but that the majority of the individual element scales were of a relatively low to medium degree of reliability. The results are believed to justify more in-depth analysis of the data and continued development efforts to refine and increase the scope of scale application. (62 pp.)

105 **Coyle, H.S., Jr., & Gorman, C.D. The utility of OER word pictures as discriminators. AFHRL-TR-70-23, AD-713 608. Lackland AFB, TX: Personnel Research Division, July 1970. Project 7719. NTIS.** Over the past several years the inflationary trend of Air Force Officer Effectiveness Reports has reached problematical proportions. The overall numerical ratings assigned to evaluate performance have become increasingly ineffective criteria for discriminating individual performance for promotion and special assignment purposes. The main goal of this study was to see if the word picture portion of the Officer Effectiveness Report can be used to discriminate performance. From a sample of 200 First Lieutenant effectiveness reports, four comparable sets of ten reports were created. Rank order criteria were established on each set by four groups of five judges, all experienced

with the rating system. After establishing an actual rank order within each set of ten ratings, the word descriptions alone were given to four groups of ten judges for rank ordering. Within each set of word pictures, average Spearman-rho correlations were computed for each group of ten judges to assess interjudge reliability. Rank order statistics were also computed for differing numbers of judges from the ten from each group to assess whether optimum reliability would occur with fewer than ten judges. Finally, a composite rank order for each set was computed by averaging the rankings across each word picture. The composite rank orders were correlated with the actual criteria ordering. Results indicated that the rank order correlations across each set of word pictures were below statistical significance. No improvement in interjudge reliability was found with any random combination of fewer than ten judges. The composite orders did not correlate significantly with the actual rank orders. A displacement effect was noted in that individuals who had received high numerical ratings tended to be ranked lower by judges than they actually ranked. The question is raised as to whether word descriptions can be used as performance discriminators. (8 pp.)

106 **Walker, G.S., & Gardner, E.M. Application of computers in educational and training systems: a survey of computer-assisted instructional centers. AFHRL-TR-70-24, AD-729 210. Lowry AFB, CO: Technical Training Division, December 1970. Project 1121. NTIS.** This paper presents an overview of representative centers active in the research, development, and application of the computer in education and training. Field visits were made to military and civilian agencies in order to obtain a cross-section of various types of applications and research projects. The information presented is based on the field visits and the most recent reports available on the activities of the various centers. Computer terminals used in computer-assisted instruction are discussed, and computer-controlled audio presentation is described. Programming languages which have been used in computer-assisted instruction are categorized, and a typical language from each category is examined. (21 pp.)

107 **Klamm, R.L., Jacobs, D., & Clark, H.J. Training potential of inflight audio/visual recording equipment for the F-4E aircraft. AFHRL-TR-70-25, AD-720 245. Wright-Patterson AFB, OH: Advanced Systems Division, December 1970. Project ILIR, Contract F33615-69-C-1816, Conductron Corporation. NTIS.** This report presents a detailed description of an Audio/Video Recording System developed to study the feasibility and training potential of inflight video recordings through the gunsight and of the instrument panel of an F-4E aircraft. The purpose of the study was to assess the value of the system as an aid in air-to-air and air-to-ground gunnery training. Flight tests were conducted in an F-4E aircraft at Nellis AFB, during which air-to-air and air-to-ground weapon delivery missions were recorded. Results of the tests proved the value of audio/video recording for training and mission evaluation, but indicated a requirement for a higher resolution video system. Additional advantages and limitations of the equipment and the tape recordings obtained are described, and it is recommended that additional tests be made with equipment capable of producing higher resolution video tapes. (34 pp.)

108 **Valentine, L.D., Jr., & Vitola, B.M. Comparison of self-motivated Air Force enlistees with draft-motivated enlistees. AFHRL-TR-70-26, AD-713 638. Lackland AFB, TX: Personnel Research Division, July 1970. Project 7719. NTIS.** Since World War II, the Air Force has relied upon voluntary enlistments to maintain its force structure. However, it is recognized that many airmen are motivated to enlist by the prospect of being drafted for the Army. As the services move toward an all-volunteer force, it is important to understand the impact of such a move on the characteristics of Air Force input. With this objective, two groups of basic trainees were defined in terms of their draft vulnerability at the time of enlistment and their stated attitude toward enlistment in the absence of a draft. These groups, identified as self-motivated and draft-motivated enlistees, were compared on a number of dimensions. From comparative data derived from the subjects' responses to a biographical survey and an attitude survey, statistically significant differences were found between the two groups. Compared with the draft-motivated enlistees, the self-motivated enlistees were less well educated,

came from a lower socio-economic background, and performed less adequately on ability tests. They were generally attracted to service by the opportunity to learn a trade and were not firmly committed to a military career at time of initial entry to service. The data also suggested that military service can be made more attractive to draft-motivated enlistees by structuring the personnel system to allow the individual more control over his fate. (18 pp.)

109 **Thomas, J.M. Retention of scientists and engineers in the Air Force: a modified model for interpreting correlates of career intent. AFHRL-TR-70-27, AD-714 550. Lackland AFB, TX: Personnel Research Division, June 1970. Project 7719. NTIS.** The primary purpose of this research was to identify factors related to career intentions of Scientists and Engineers in the Air Force. A secondary purpose was to examine the assumptions underlying general organizational retention research for relevance to Air Force retention studies. A literature review was conducted and a theoretical discussion of the typical assumptions in retention research was presented. Several of these assumptions were shown to be questionably applicable to Air Force retention research. A survey of Scientists and Engineers in the Air Force was then analyzed and interpreted using a modified model based on the theoretical discussion. Results of the survey suggested that career-oriented Scientists and Engineers may have a different need structure than their non-career-oriented counterparts. Needs for managing and applied research seemed to characterize the career-oriented Scientist, while needs for pure research and scientific achievement seemed to characterize the non-career-oriented Scientist. Career-oriented officers were generally more optimistic about satisfying important needs while in the Air Force, and they preferred a professional-officer identity to a professional-Scientist identity. Modest correlations between various aspects of active duty experience and career intent suggest that pre-commissioning attitudes, particularly their sources and relative impact on career decisions, should be investigated further. Career-oriented Scientists and Engineers may start out career-oriented and their active duty experiences simply sustain that orientation. Likewise, the non-career-oriented Scientists and Engineers may simply perceive active duty experiences as supporting their initial attitudes regarding a military career. This leaves only the initially undecided group to be significantly influenced by the quality of their active duty experiences. (29 pp.)

110 **Mullins, C.J., Massey, I.H., & Riederich, L.D. Why airmen enlist. AFHRL-TR-70-29, AD-714 551. Lackland AFB, TX: Personnel Research Division, August 1970. Project 7719. NTIS.** The Air Force Questionnaire was administered to 41,098 newly enlisted airmen. One-way distributions were made of all responses, and then two-way distributional relationships were computed between reasons for enlistment and other selected variables. Educational opportunity was the reason most frequently given for Air Force enlistment, followed by wide choice of assignments and then opportunity to travel. Reasons for enlistment appear to be associated with various other variables, such as indications of the subject's attitude toward enlistment in the absence of a draft, his career intentions, his previous work experience, his race, his educational level, and his mental ability category. (32 pp.)

111 **Wood, M.E. Continuously adaptive vs discrete changes of task difficulty in the training of a complex perceptual-motor task. AFHRL-TR-70-30, AD-723 311. Williams AFB, AZ: Flying Training Division, August 1970. Project 1710. NTIS.** The purpose of this effort was to determine the benefits to be derived from the adaptive training technique of automatically adjusting task difficulty as a function of a student skill during early learning of a complex perceptual motor task.

A digital computer provided the task dynamics, scoring, and adaptive control of a second-order, two-axis, compensatory tracking task. Two adaptive training methods were compared: (1) Continuous automatic adjustment of task difficulty during acquisition; and (2) A schedule of increasing levels of fixed difficulty during acquisition training. Comparisons were made between groups on the basis of criterion task performance during and after acquisition training.

Results indicate that acquisition practice under increasing levels of fixed difficulty is significantly superior to practice under conditions of continuous adjustment of task difficulty. (22 pp.)

112 **Wood, M.E. Improved crew member training through a new philosophy toward training. AFHRL-TR-70-31, AD-723 313. Williams AFB, AZ: Flying Training Division, August 1970. Project 1123. NTIS.** New emphasis on the total learning process is bringing about significant changes in both the educational and training communities. The process-oriented, systems approach to training integrates behavioral objectives, media, and instructors in such a way that increased training effectiveness is realized through a greater ability to deal with the learning requirements of the individual student. Based on current United States Air Force efforts to employ and evaluate this general approach to training, new efficiencies in instruction are indicated. This system will provide a basis for defining the characteristics of future UPT multi-media systems. The basic principles inherent in the new-look in training appear to be generally applicable to all phases of crew-member training. (9 pp.)

113 **Fowler, V.J., & Reich, S.M. Wide-angle rotating-mirror scan system for use in laser display system. AFHRL-TR-70-32, AD-721 449. Wright-Patterson AFB, OH: Advanced Systems Division, November 1970. Project ILIR, Contract F33615-69-C-1855, General Telephone and Electronics Laboratories, Inc. NTIS.** This program covers the design development and fabrication of a wide-angle rotating mirror scanner for use in laser display systems. A hysteresis synchronous motor designed for operation at 300,000 rpm and employing gas bearings was fabricated and tested. Operation to 240,000 rpm was achieved with ball bearings, while limited success was obtained with gas bearings. In addition, hydrostatic gas-film-lubricated bearings made from copper impregnated tungsten were fabricated and tested. (59 pp.)

114 **Wood, M.E., & Hagin, W.V. Airborne audio-video recording design considerations. AFHRL-TR-70-33, AD-727 025. Williams AFB, AZ: Flying Training Division, November 1970. Project 1123. NTIS.** A brief summary of recent airborne audio-video recording research is presented. Based on this research, and recent Air Training Command requirements for an operational airborne audio-video recording system, discussion is presented which considers the several design goals which are involved in the design of any airborne audio-video recording system. Further, an engineering development philosophy is provided which weights current requirements against various aspects of the state of the art in audio-video technology. (11 pp.)

115 **Wood, M.E. Single-concept films in the training of flight skills. AFHRL-TR-70-34, AD-728 685. Williams AFB, AZ: Flying Training Division, November 1970. Project 1710. NTIS.** A study was conducted in cooperation with the 3646th Pilot Training Wing, Laughlin Air Force Base, Texas to determine the effectiveness of single-concept films in the training of T-37 landing maneuvers. Film study significantly reduced the amount of air time required to reach or exceed the levels of proficiency demonstrated by baseline students in normal landing practice. The study also provided insights into the production of in-flight films and their subsequent use as cartridge-loaded, single-concept film materials. (31 pp.)

116 **Guinn, N., Tupes, E.C., & Alley, W.E. Cultural subgroup differences in the relationships between Air Force aptitude composites and training criteria. AFHRL-TR-70-35, AD-715 922. Lackland AFB, TX: Personnel Research Division, September 1970. Project 7719. NTIS.** This study was designed to explore the relationship between aptitude index composite and final school grade in technical training for various cultural subgroups based on race, educational level, and geographical area of enlistment. Regressions of final school grade on aptitude index were compared for the different subgroups in ten samples of technical school graduates. Results indicated that where the relationship between aptitude score and performance in technical training differed for the various subgroups, the performance of Negroes and high school non-graduates was overestimated. No consistent trend in prediction error was noted for the various areas of enlistment across all technical schools. However, there was a general tendency for the final school grade for personnel from the North-Northeast area to be overpredicted while those from the Far West-Pacific Coast area tended to be underpredicted. (17 pp.)

117 **Mullins, C.J., & Usdin, E. Estimation of validity in the absence of a criterion. AFHRL-TR-70-36, AD-716 809. Lackland AFB, TX: Personnel Research Division, October 1970. Project 7717, Contract F41609-69-C-0041, Southwestern Computing Service, Inc. NTIS.** In a training situation, standard procedures to predict performance entail a long delay between the request for a prediction instrument and its delivery. In this study, methods were developed for constructing prediction instruments at the time of request, rather than requiring the necessary time elapse for maturation of criterion data. The prediction systems developed by these methods were about as effective as instruments developed by the classical methods. The synthetic methods utilized estimates of performance made by experts in the training area as substitutes for actual performance. These methods, therefore, can be used before a course has even been given for the first time. (23 pp.)

118 **Federico, P.A. Development of psychometric measures of student attitudes toward technical training: reliability and factorial validity. AFHRL-TR-70-37, AD-723 314. Lowry AFB, CO: Technical Training Division, November 1970. Project 1121. NTIS.** This reported investigation is the Phase I effort of a task which undertakes to develop a new student critique form for Air Training Command (ATC). Specifically, it deals with the identification of valid and reliable psychometric measures of student attitudes toward Air Force technical training. Two critique form prototypes were developed using a Likert-type and a Guttman-type configuration. These were administered in a counterbalanced order to samples of officers, NCO, and airmen enrolled in an ATC technical school. Multiple-factor analyses and multiple discriminant function analyses were performed for the scored responses of the subjects to these critique forms. Test-retest reliability and factorial and discriminative validities were established for each of the prototypes. On the basis of the statistical analyses of the two forms, the Likert configuration was recommended for further development. Eight Likert factors, or unidimensional scales, were defined: Instructor Competence, Training Management, Specialty Training, Training Impressions, Training Facilities, Repetitious Instruction, Intelligible Media, and Textbook Utility. Because of demonstrated differences between rater groups, it was also recommended that group-specific forms be developed. (52 pp.)

119 **Goebel, R.A., Williamson, R.L., & Baum, D.R. Effects of "real world" radio chatter on mid-phase instrument ground trainer proficiency: a pilot study. AFHRL-TR-70-38, AD-727 054. Williams AFB, AZ: Flying Training Division, November 1970. Project 1123. NTIS.** Under a background condition of either recorded radio chatter or no radio chatter, the individual performances of two flights of mid-phase instrument student pilots were measured during a simulated instrument cross-country mission in the T-38 ground trainer. Operational constraints prevented the exercise of optimal experimental controls, thereby precluding definitive conclusions concerning the effects of radio chatter on performance. Nevertheless, the study established certain methodological guidelines for future research. Additionally, analysis of the comments of those students receiving radio chatter revealed that the vast majority reacted favorably and enthusiastically to the chatter because it afforded the mission a high degree of realism. (8 pp.)

120 **Gragg, D.B. Identification of logistics officer job type groups. AFHRL-TR-70-39, AD-718 952. Lackland AFB, TX: Personnel Division, October 1970. Project 7734. NTIS.** A job inventory covering the logistics Utilization Field, and consisting of 307 tasks classified under nine duty categories was administered to an analysis sample of 613 officers in 20 major commands, and in six grades from colonel to second lieutenant. These incumbents completed a background information section, and, on a seven-point scale of relative values, rated each task performed as a part of their job. In spite of the fact that the utilization field has only two specialties, Logistics Staff Officer (6616) and Logistics Officer (6624), the work is heterogeneous in terms of percentage of job which individual officers devote to common tasks. This heterogeneity is indicated by the average overlap of only 15 percent in the effort expended by individuals within the total sample. In addition to the data usually employed in identifying job type groups, two other sources of information were used: the current duty title of

the incumbents, extracted from the Uniform Officer Record files; and the percentage of the job devoted to task categories, generated by reclassifying the tasks according to kind of work rather than according to action taken, as in the case of duties appearing in the inventory. A total of 61 job type groups were identified by analysis of data from an automated program of job clustering based on overlap of effort expended on tasks by individual members. These 61 groups comprise 48 job types and the 8 clusters and 5 subclusters formed by similar job types grouped into larger aggregates. Of the 613 officer jobs surveyed, 129, or 21 percent, did not fall into any of the 61 groups. The low homogeneity of individual jobs is compared with the considerable degree of overlap of group averages of effort expended on common tasks. The two additional sources of information, the current duty titles of the UOR and the recategorization of tasks by kind of work performed, are suggested for use in officer analyses. It is also suggested that task categorization by kind of work may be used during inventory construction to insure adequate work coverage and to aid in writing more specific task statements. It is hypothesized that greater task specificity will enhance the identification of officer job type groups. (24 pp.)

121 **Reid, G.B., Hagin, W.V., & Coats, D.H. Assessment of two methods of sequencing ground trainer practice for undergraduate pilot training. AFHRL-TR-70-40, AD-728 687. Williams AFB, AZ: Flying Training Division, December 1970. Project 1123. NTIS.** This study was an operational evaluation of two methods of instruction sequencing for the T-38 phase of Undergraduate Pilot Training. Scheduling of concentrated trainer phases prior to aircraft flight improved student performance for early aircraft rides as compared with an intermixed trainer and aircraft schedule. Although grade differences washed out prior to graduation, the students who trained under the block schedule completed training in 38 fewer aircraft flights than the students who trained under the intermixed schedule. (8 pp.)

122 **Mullins, C.J., & Massey, I.H. Why young men apply for Air Force commissions. AFHRL-TR-70-41, AD-718 953. Lackland AFB, TX: Personnel Division, November 1970. Project 7719. NTIS.** The Air Force Questionnaire was administered to 3,141 Officer Training School trainees. One-way distributions were made of all responses, and then two-way distributions were made of reasons for joining and other selected variables. Educational opportunities was the reason most frequently given for joining the Air Force; being treated with respect and working with a nice group of people were the next most frequently chosen reasons. Reasons for joining appear to be associated with certain other variables, such as attitude toward military service in the absence of a draft, attitude toward military service as a career, and geographic area of enlistment. (33 pp.)

123 **Mead, D.F. Development of an equation for evaluating job difficulty. AFHRL-TR-70-42, AD-720 253. Lackland AFB, TX: Personnel Division, November 1970. Project 7734. NTIS.** This is the first in a series of studies designed to produce a method for evaluating the difficulty levels of Air Force enlisted jobs. In this particular study, 250 job descriptions in the Medical Materiel Career Ladder were ranked on difficulty by supervising personnel, using a complex partitioning system. Computation of interrater agreement for these rankings yielded an r of .93. Twenty-one variables were defined which might have entered into the judgments made by supervisors, and regression analyses subsequently identified three variables which predicted the job difficulty rankings with an R of .95. These three predictor variables were Number of Tasks Performed, Difficulty of Tasks Performed per Unit Time, and Number of Tasks Performed, Squared. Application of a shrinkage correction formula to test for chance errors resulted in a negligible correction to the obtained R. Developing weights for the three predictor variables in separate samples and cross-applying to predict the difficulty level of jobs in the opposite group yielded an R of .94 in both cross-applications. Comparisons of the rank order positions of the criterion jobs using predicted and rated difficulty values revealed nonsignificant differences. Results of this study indicate that the difficulty level of jobs within the Medical Materiel Career Ladder can be adequately determined using the derived three-variable regression equation. (10 pp.)

124 **Mead, D.F. Continuation study on development of a method for evaluating job difficulty. AFHRL-TR-70-43, AD-720 254. Lackland AFB, TX: Personnel Division, November 1970. Project 7734. NTIS.** This paper describes the development of a multiple regression equation which satisfactorily predicted the difficulty level of 250 jobs from the Vehicle Maintenance Career Ladder. The correlation between the predicted values and the criterion values assigned the jobs by Air Force supervisors was .93. The research design was a replication of one used earlier with jobs from the Medical Materiel ladder. The results obtained in this study support the major findings of the earlier investigation. The same basic predictor variables combined to form the most effective prediction equation in both investigations. The primary factors reflected in the job difficulty evaluation policy were number of tasks in the job description, difficulty level of tasks performed, and time spent performing the tasks. These findings provide support for the hypothesis that there are common factors which influence supervisors' judgments of job difficulty in all Air Force career ladders. (12 pp.)

125 **Mead, D.F., & Christal, R.E. Development of a constant standard weight equation for evaluating job difficulty. AFHRL-TR-70-44, AD-720 255. Lackland AFB, TX: Personnel Division, November 1970. Project 7734. NTIS.** This paper describes the development of a multiple regression equation which captured the job difficulty evaluation policy of Accounting and Finance supervisors. The equation yielded predicted difficulty values for 250 jobs which correlated .95 with the supervisory rankings.

These results validated the findings of two previous job difficulty studies using jobs from the Vehicle Maintenance and Medical Materiel Career Ladders. A constant standard weight equation was developed which reflected the job evaluation policy of supervisors from the three diverse career fields. Applying this equation to the appropriate predictor data from the three studies yielded valid difficulty measures for 750 jobs within the three career ladders tested. (11 pp.)

126 **Connelly, E.M., Schuler, A.R., Bourne, F.J., & Knoop, P.A. Application of adaptive mathematical models to a T-37 pilot performance measurement problem. AFHRL-TR-70-45, AD-726 632. Wright-Patterson AFB, OH: Advanced Systems Division, January 1971. Project 6114, Contract F33615-69-C-1415, Melpar, An American – Standard Company. NTIS.** This report documents experimental research on a new method of deriving performance measures and criteria for use in automated pilot performance evaluation. Data recorded on board a T-37B aircraft (tail number 58-1948) were submitted to a previously implemented system of adaptive mathematical models (AMM). The results were analyzed to determine the practical capability of the AMM in automatically deriving measures and criteria. Flight data for a series of performances of the Lazy 8 and Barrel Roll maneuvers were processed first by a set of Boolean functions. These functions describe the data in the form of Boolean time sequences (BTS), which are then operated upon by the AMM to derive three types of performance measures: (1) State Transfer Measures, which are based on overall trends in the performance; (2) Absolute Measures, which are based on a comparison of actual performance with some reference; and (3) Relative Measures, which are based on relations among performance variables. The results show that the AMM system can be used to effect a systematic attack on the problems of performance measurement using representative flight data. Face-validity of measures derived by the AMM is illustrated by comparison with performance evaluations made by an instructor pilot. (242 pp.)

127 **Federico, P.A. Some effects of inflating information feedback on the acquisitions of a discrete lever-positioning response. AFHRL-TR-70-46, AD-716 372. Lowry AFB, CO: Technical Training Division, October 1970. Project 1121. NTIS.** One hundred sixty military trainees who were randomly placed into four equal groups were taught to displace a lever to an initial target by an error training procedure. Unknown to these Ss, the target position shifted; Ss were then trained to move the lever to this new target. During this phase of countertraining (CT), information feedback (IF) was inflated by different factors for each of the three experimental groups. The control group in this stage

received the same unamplified IF which all groups were given during initial training. Ss receiving exaggerated IF neither engaged in more hunting behavior for the CI target, nor oscillated around it over and above those Ss not given misproportioned IF. Individual differences in responding were greater for the control group than any of the experimental groups. The second half of countertraining for all groups was marked by a progressive deterioration in S-alignment. The most pronounced effects of IF distortion did not occur during the first CT trial as expected. All Ss approached at the same rate a common asymptote as a limit. There was an absence of any powerful tendency to perseverate in moving to the initial target during countertraining. The cognitive relationship established by some of the groups between the IF- and R-scale did not differ suggesting that some of the transformations adopted were psychologically meaningless. (13 pp.)

128 **Smith, E.A., & Kincaid, J.P. Derivation and validation of the automated readability index for use with technical materials. AFHRL-TR-70-47, AD-716 314. Lowry AFB, CO: Technical Training Division, October 1970. Project 1121. NTIS.** The utility of technical materials is influenced to a marked extent by their reading level or readability. This article describes the derivation and validation of Automated Readability Index (ARI) for use with technical materials. The method allows for the easy, automatic collection of data as narrative material is typed on a slightly modified electric typewriter. Data collected include word length (a measure of word difficulty) and sentence length (a measure of sentence difficulty). Appropriate weightings of these factors in a multiple regression equation result in an index of reading difficulty. Uses of the index for evaluating and controlling the readability of large quantities of technical material are described. (8 pp.)

129 **Black, D.E., & Bottenberg, R.A. Comparison of technical school and on-the-job training as methods of skill upgrading. AFHRL-TR-70-48, AD-726 530. Lackland AFB, TX: Personnel Division, December 1970. Project 6323. NTIS.** In the Air Force, basic technical skills classified as Category B skills are those in which a portion of the total personnel requirement is formally trained in a technical training course and the remainder is trained on the job (OJT). Determination of the relative numbers of airmen to be trained in formal courses and in on-the-job training is based, in part, upon the time required to qualify a specialist at the five-skill, or fully qualified level. This report provides information on rates of progression to the five-skill level in Category B skills by comparing samples of technical school and on-the-job training personnel. Development of the methodology used to measure the rates of progression to the five-skill level was described, along with an explanation of the achievement ratio defined in this study. Achievement rates from Basic Military training (BMT) graduation to award of the five-skill level were investigated. In the majority of the Category B specialties, there was inconclusive evidence of any advantage for technical training over OJT. In the specialties in which there were substantial differences between the two groups, the differences in most cases favored technical training. There were two specialties in which neither training group was superior to the other. The achievement rates after award of the three-skill level (i.e., apprentice level) to award of the five-skill level were not entirely consistent with achievement rates from BMT graduation to the five-skill level. In many cases, it was found that OJT personnel progressed more rapidly than technical school personnel from the three-skill to the five-skill level. (11 pp.)

130 **Shenk, F. Changes in career intent during initial tour of active duty. AFHRL-TR-70-49, AD-722 408. Lackland AFB, TX: Personnel Division, December 1970. Project 7719. NTIS.** This is the fourth report of a historical study of the 1963-1964 officer input from the principal Air Force commissioning programs. This study was designed to determine the predictability of an Air Force officer's career decision and to evaluate relationships between career intent and various demographic, environmental and attitudinal factors. Information on this group has been compiled for the period before commissioning and through five years of active duty. This report presents a description of the results obtained during the second through fifth years of active duty for this group. Based on responses to the career-intent statement, the most favorable source for retention is OCS, followed closely by OTS-AECP, both sources having had prior military service. Among the various sources,

there has been a gradual trend toward lower career intent through the third year of active duty. At that point, career attitudes appear to begin stabilizing and continue to stabilize through the fifth year of active duty. Factors which influenced decisions to leave the Air Force included dissatisfaction with job, separation from family, friends, and hometown, and limitations in opportunity for promotion or for increased responsibility. Job characteristics considered important centered around job satisfaction. Generally, it seemed that the more factors the subject perceived as possible of attainment in the Air Force, the more likely he was to be career-oriented. (42 pp.)

131 **Ratliff, F.R., Chiorini, J.R., Curran, C.R., & Shore, C.W. Evaluating combat crew training performance using criteria of minimum performance standards. AFHRL-TR-70-50, AD-722 409. Lackland AFB, TX: Personnel Division, November 1970. Project 6323. NTIS.** An 11-point rating scale and minimum acceptable performance criteria were developed for each training phase of F-4 combat crew training to measure training progress and compare the performance of two groups of student aircraft commanders. Instructor pilots rated the performance of student aircraft commanders who were either upgrading second-seat crewmembers or recent undergraduate pilot training (UPT) graduates. The objectives were to determine the effects on performance in combat crew training school of experiences as F-4 second-seat crewmembers, and to determine whether recent UPT graduates with no experience as second-seat crewmembers could meet the minimum performance standards of combat crew training in the amount of time currently allotted. The students were rated against the criteria of minimum acceptable performance using standardized rating procedures. Several conclusions were reached on the basis of this study; (*a*) Proficiency ratings made against criteria of minimum acceptable performance can be used to measure training progress and compare rates of gain in proficiency between two or more groups. (*b*) Experience as F-4 second-seat crewmembers resulted in higher proficiency ratings at the beginning of most training phases for the upgrading second-seat crewmembers. (*c*) Recent UPT graduates improved their rated performance to achieve levels of proficiency similar to the upgrading second-seat crewmembers by the end of most training phases. (*d*) Students from the top 10 percent of their UPT classes should be able to successfully complete F-4 combat crew training as aircraft commanders in the amount of time currently allotted without previous exposure to the F-4 as second-seat crewmembers. (26 pp.)

132 **Mays, J.A. The development and evaluation of a ultra-high resolution television system. AFHRL-TR-71-1, AD-885 826. Wright-Patterson AFB, OH: Advanced Systems Division, February 1971. Project 6114, Contract F33615-69-C-1382, Systems Research Laboratories, Inc. NTIS.** The report describes the development of a Ultra-High Resolution television system, capable of operating at 2047 or 1023 lines/30 frames per second, and the evaluation of the television system with three high-resolution vidicons. The report describes the electronic circuitry developed, in particular the extremely wideband video preamplifier and video processor. The evaluation phase of the program includes data concerning the performance of the television system and the three vidicons. The evaluation found that the television system is capable of operating at the proposed 2047 and 1023 TV lines/30 frames per second and meets the design goal of 90 MHz video bandwidth. The evaluation of the three vidicons included: (1) the RCA type 4586, (2) the General Electrodynamics type 1347-001 one inch electrostatic deflection, electrostatic focus vidicons employing an additional magnetic focus coil for improved resolution, and (3) a GE type Z7940 1-1/2 inch electrostatic deflection, magnetic focus (FPS) vidicon. Each of the vidicons was found to have both good and bad qualities; the use of any one of them would have to be based upon the requirements of the system. The conclusion reached by examination of the resultant data supports the belief that television systems employing very wide bandwidth and high scan rates are quite possible and will result in a substantial advancement in the state-of-the-art of simulation. (58 pp.)

133 **Winkler, A.J., & Thompson, P.D. Post-service utilization of Air Force-gained skills. AFHRL-TR-71-2, AD-736 453. Alexandria, VA: Manpower Development Division, September 1971. Project 4499. NTIS.** More complete information is needed to determine the extent of utilization in

the civilian economy of skills developed during military service. Post-service occupation data have been obtained through a questionnaire mailed ten months after separation to each first-term Air Force enlisted man separated between 1 July 1968 and 31 March 1970. As of 31 December 1970, data were available on 85,409, or 51.7 percent, of the men separated during this period. This study demonstrates that 72 percent of the first-term separatees who were in high-skill, blue-collar-like, Air Force occupations were employed in similar civilian occupations. There were six Air Force career fields for which 51 through 80 percent of the separatees transitioned into occupations which directly utilized their Air Force skills. Of 34 Air Force Specialties with a variable reenlistment bonus multiple of four, 31 had a utilization rate greater than 25 percent. Continued research in this area is planned. (27 pp.)

134 **Talbert, G.E., Hourigan, J.P., & Hoyt, J.L. An analysis of the system for determining and validating Air Force professional education requirements. AFHRL-TR-71-3, AD-738 300. Maxwell AFB, AL: Professional Education Division, April 1971. Project 1125, Contract F41609-70-C-0038, System Development Corporation. NTIS.** The purpose of this exploratory development study was to perform a systems analysis of the Air Force professional education system, including the development and analysis of descriptive models and alternative system procedures, for use in ensuring that the most effective and systematic procedures are being used for determining, validating and meeting educational requirements. The focus of the study was upon the professional development of career officers via the formal programs and courses of Air University. A conceptual model was developed wherein the system was described as encompassing four major functional subsystems: Requirements determination, personnel selection, academic instruction, and validation. Data bearing on the functioning and interrelationships of each of these subsystems was developed through discussions with personnel at cognizant agencies and through reviews of documentary data sources. Based on these data, a descriptive model in flow-diagrammatic and narrative form of the current system was developed to show the processing procedures, information flows, and interrelationships among the agencies, programs, and structures which together comprise the educational system and its embedding environment. This descriptive model was analyzed to identify merits and deficiencies in the current system, alternative processing procedures were examined, and a prototype model of a procedure for quantifying and prioritizing educational requirements was developed. While several procedural modifications are suggested, it was concluded that the principal benefits of the study lie in its descriptive rather than its prescriptive aspects due in most instances to an inability to estimate with confidence the effect that a given change may have on overall system performance without further and more intensive research and analysis. (95 pp.)

135 **Valverde, H.H., & Burkett, B.P. A systems approach to C-130E aircrew transitional training. AFHRL-TR-71-4, AD-727 055. Wright-Patterson AFB, OH: Advanced Systems Division, March 1971. Project 1710. NTIS.** This report describes the development and evaluation of a Tactical Air Command (TAC) C-130E transitional aircrew training program based on a systems approach. The systems approach to training emphasizes the importance of specifying objectives derived from a task analysis of the aircrew member's job. A training program was prepared to develop proficiency in the specific duties required of the C-130E pilot, co-pilot, and the flight engineer. The training program was designed to be highly job relevant and included multimedia and self-instructional materials. Training objectives were derived from a task analysis of the C-130E aircrew members's job requirements. Aircrew flight training course materials and various training media were prepared based on the specific end-of-course objectives. The training program was evaluated over a six-month period, revised as needed, and implemented by TAC in the USAF formal school for C-130E transitional training for all military services. The results were as follows: (1) students in the new course achieved all training objectives, (2) classroom instruction was reduced about 50%, (3) flying hours were reduced from 45 to 35 hours, (4) length of training was reduced 37% per trainee, (5) pilots and co-pilots, graduates of the new course, were rated significantly higher by their supervisors than were graduates of the old

course, (6) there was no significant difference in ratings received by the two flight engineer groups, and (7) verified annual savings of about five million dollars was realized. (67 pp.)

136 **Hulin, C.L., & Alvares, K.M. An evaluation of three possible explanations of the temporal decay in predicting pilot proficiency. AFHRL-TR-71-5, AD-731 191. Williams AFB, AZ: Flying Training Division, February 1971. Project 1123, Contract F41609-70-C-0027, The University of Illinois. NTIS.** The fact that Air Force pilot selection tests do not adequately predict pilot success in operational tactical units is consistent with the generally reported finding that correlations between ability measures and performance decrease over time. This effort investigated the validity of three explanations for this predictive decay: (*a*) tasks are restructured during training, (*b*) basic abilities are altered as a function of training, and (*c*) both of these changes occur. Two groups of students were administered an extensive battery of ability tests at the beginning and again at the end of a 16-week period. The experimental subjects received basic flight training during this interval, whereas the control subjects did not. Support for the third hypothesis resulted from appropriate comparisons between the groups' pretest and posttest scores on ability measures, as well as analysis of the experimental group's flight training performance. The implication of this finding for both selection and training research is discussed. (14 pp.)

137 **Hulin, C.L., & Alvares, K.M. Three explanations of temporal changes in ability-skill relationships: literature review and theoretical analysis. AFHRL-TR-71-6, AD-732 612. Williams AFB, AZ: Flying Training Division, February 1971. Project 1123, Contract F41609-70-C-0027, The University of Illinois. NTIS.** This report reviews and integrates the empirical and theoretical literature relevant to the temporally decreasing predictive relationship between ability measures and complex motor task performance. An extensive historical review of complex motor skill learning revealed that two distinct theoretical models have been advanced. Both of these models, the changing task and the changing subject models, adequately account for this predictive decay. One model assumes that changes occur within the task structure; i.e., changes occur in the relative importance of abilities in determining performance. The other assumes that the ability levels themselves change within a fixed task structure. This paper presents a third model, a combination of the first two, and discusses the need for empirical evidence allowing a choice among the three models. (16 pp.)

138 **Hulin, C.L., & Alvares, K.M. Effects of the man on the task in complex man-machine systems. AFHRL-TR-71-7, AD-732 613. Williams AFB, AZ: Flying Training Division, February 1971. Project 1123, Contract F41609-70-C-0027, The University of Illinois. NTIS.** This research tested the hypothesis that in a complex man-machine system one of the many influences on the system is the man's constant reorganization of the tasks which constitute the system. The performance of 67 male college students receiving basic flight training were assessed by means of check rides at three different points of training. Factor analyses of each set of check ride data indicated systematic changes occurred in the structure of the task. A three-factor solution appeared in the 10-hour data, two factors were being assessed by the 25-hour points, and only one general factor appeared in the 35-hour data. This finding indicates that future man-machine systems research should no longer be designed under a fixed-task assumption. The authors speculate that this assumption may be one cause of the generally found weak prediction of system performance effectiveness over meaningful intervals of time. (7 pp.)

139 **Federico, P.A. Degree of evaluative assertions ascribed to an attitude universe as a function of measurement format. AFHRL-TR-71-8, AD-736 788. Lowry AFB, CO: Techical Training Division, December 1971. Project 1121. NTIS.** Two-hundred-eighty-nine Air Force students were presented in counterbalanced order within-*Ss* two critique forms to gauge their attitudes toward military technical training. The content of each of 55 items was structured according to two different formats: a Likert-type and a Guttman-type configuration. The forms were similar in the sense that for each item

written in the Likert format there was a corresponding item written in the Guttman format which had essentially the same content. Not only were all items within one attitude form of the same structure, but also all were composed in such a manner to reduce as much as possible variability among items due to phraseology. Each item was randomly placed in its sequential position among the 55 items of each form; and each item maintained the same sequential position within both forms. Items were scored according to customary Likert and Guttman procedures. A multiple discriminant analysis and its associated statistics were computed for these data between measurement formats. *Ss* demonstrated significantly more favorable attitudes toward analogous content areas on the Guttman-structured items than on the Likert-structured items. Evidently, item formatting did affect the degree of the evaluative assertions ascribed to the attitude universe. These results were explained in terms of several alternative theories, namely: anchoring, adaptation-level, and intensity interpretations. (10 pp.)

140 **Vitola, B.M., & Wilbourn, J.M. Comparative performance of male and female enlistees on Air Force selection measures. AFHRL-TR-71-9, AD-726 531. Lackland AFB, TX: Personnel Division, February 1971. Project 7717. NTIS.** Male and female enlistee samples were compared for total groups and by enlistment region in terms of their performance on the Airman Qualifying Examination (AQE) and the Armed Services Vocational Aptitude Battery (ASVAB). Women in the Air Force (WAF) test-retest performance was evaluated on the Armed Forces Women's Selection Test (AFWST) which is used throughout the Department of Defense. WAF performance on the AFWST was compared with their performance on the Armed Forces Qualification Test (AFQT), the instrument currently used to establish the mental ability level of males entering the military services. It was found that mean aptitude indexes have increased over time for both male and female enlistees on the AQE and the ASVAB. A positive relationship was demonstrated between level of education and aptitude index. Regional aptitude patterns for WAF did not conform to those traditionally found for male enlistees. A significant difference was found in WAF performance in a test-retest situation for both the AQE and the AFWST. WAF performance on the AFQT was somewhat lower than that of male enlistees, with the difference attributed primarily to the lower achievement by the WAF on the Mechanical Comprehension subtest. (13 pp.)

141 **Vitola, B.M., & Valentine, L.D., Jr. Assessment of Air Force accessions by draft-vulnerability category. AFHRL-TR-71-10, AD-724 094. Lackland AFB, TX: Personnel Division, March 1971. Project 7719. NTIS.** As the Armed Forces move toward a zero-draft force, assessment of the characteristics of current Air Force accessions becomes necessary. While the Air Force has relied upon voluntary enlistments to maintain its force strength, it has been recognized that many young men who enlist are motivated to do so by the prospect of being drafted. On the basis of draft lottery number, four groups of basic trainees enlisting during the first six months of 1970 were defined in terms of their draft vulnerability at the time of enlistment. These groups, designated as high, moderate, low, and no threat, were compared on a number of dimensions. Compared to the other groups and to the total group, the test performance of the low-threat group was somewhat lower. In addition, there were significant differences between the no-threat group, the other groups, and the total group. In various comparisons on test performance, there were marked differences between racial and enlistment region subgroups, but only moderate differences within draft-threat groups. The data suggest that under zero-draft conditions manpower resources at the higher aptitude levels may be more limited than is presently the case. (12 pp.)

142 **Mitchell, R.L., Lucero, A.B., Harrison, R.E., & Arnold, D.J. Synthesis of high-resolution radar systems for display simulation and training. AFHRL-TR-71-11, AD-734 548. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 6114, Contract F33615-70-C-1610, Technology Service Corporation. NTIS.** A comprehensive analysis was conducted of the theory and practice of utilizing digital techniques for simulating high-resolution radar systems. The objective was to simulate radar displays of cultural complexes for navigation training. Three major phases of this effort are: (1)

develop tractable scattering models, (2) construct a data base, and (3) define a simulation procedure that is computationally efficient. The techniques developed in this report are generally applicable for any radar system, whether of brute-force type or synthetic aperture. To validate the approach, a 30 city-block area is incorporated into a digital data base by using photogrammetric techniques on aerial photography. From this data base, a radar display is simulated that is in good agreement with actual radar imagery. The practicality of a real-time digital simulation is demonstrated. (75 pp.)

143 **Fisher, A.H., Jr. Army "new standards" personnel: relationships between literacy level and indices of military performance. AFHRL-TR-71-12, AD-727 764. Alexandria, VA: Manpower Development Division, April 1971. Project 4499, Contract DAHC 19-70-C-0012, Human Resources Research Organization (HumRRO). NTIS.** In 1966 the Department of Defense lowered entrance standards for military service. Men who enter the service as a result of this action are called "New Standards" men. In this research the relationship between literacy status of a sample of New Standards men after 23 months of Army service and various indices of military performance was determined. A second objective was to develop an equation for predicting 23-month literacy status. Analysis was carried out for 3,009 men on data extracted from the computerized Project 100,000 Data File. Literacy status at 23 months was found to be only slightly, although positively, related to most of the performance and status indices. A regression equation was developed for predicting 23-month literacy status on the basis of entry characteristics using half the sample and produced a multiple correlation of +.62; a cross-validation test on the other half of the sample showed a correlation of +.60. (28 pp.)

144 **Fisher, A.H., Jr. Army "new standards" personnel: effect of remedial literacy training on performance in military service. AFHRL-TR-71-13, AD-727 765. Alexandria, VA: Manpower Development Division, April 1971. Project 4499, Contract DAHC 19-70-C-0012, Human Resources Research Organization (HumRRO). NTIS.** In 1966 the Department of Defense lowered entrance standards for military service. Many of the "New Standards" men who then entered the service were placed in remedial training programs (Army Preparatory Training, APT), designed to upgrade their literacy status to a fifth-grade level or higher. This research sought to determine whether "success" in remedial literacy training was associated with superior military performance. Another objective was to develop an equation for predicting terminal literacy scores. Analysis for 9,000 Army personnel was carried out on data extracted from the computerized Project 100,000 data file. Men who were successful and unsuccessful, respectively, in literacy training did not differ greatly in most performance indices. Successful trainees were slightly more likely to achieve higher pay grades and to be judged eligible for reenlistment. A multiple regression equation was developed for predicting success in the literacy training course. This analysis, using a randomly selected half of the group, yielded a multiple correlation of +.52; cross-validation with the remaining half of the group produced a correlation of +.50. (30 pp.)

145 **Wood, M.E. Multi-media in USAF pilot training. AFHRL-TR-71-14, AD-732 611. Williams AFB, AZ: Flying Training Division, October 1971. Project 1123. NTIS.** The flight-line portion of flying training has traditionally required large amounts of airborne practice under an apprenticeship form of instruction. New developments in educational technology, from both a philosophical and device point of view, provide new opportunities to train airborne skills in a ground environment. Through the use of multi-media instructional techniques, within the context of a systematic approach to training, much can be done to improve the overall efficiency of actual airborne practice. (12 pp.)

146 **Harding, F.D., & Richards, J.A. A descriptive analysis of the classification, assignment, and separation systems of the armed services. AFHRL-TR-71-15, AD-730 591. Alexandria, VA: Manpower Development Division, May 1971. Project 4499, Contract F41609-70-C-0037, Human Resources Research Organization (HumRRO). NTIS.** Each year many thousands of young men

transfer between civilian life and the Armed Services. Because of the impact of military service on occupational aspiration and career development, it is important to develop a thorough understanding of the interaction between the military and civilian manpower systems. The purpose of this study is to describe the classification and assignment process applied to men entering military service and to similarly describe the process followed for their separation from the service. Special attention is given to how previously acquired skills are identified and acted upon and how the recruit's occupational preferences and interests are related to his classification and assignment. The nature of the counseling, training, and placement activities is the focal point of the description of the separation process. Information was obtained from a review of official policies, procedures, and manuals; interviews with staff members; and observation of the classification, assignment, and separation processes. A comparative analysis was made of the procedures of the Air Force, Army, Marine Corps, and Navy. (39 pp.)

147 **Federico, P.A. Identifying item validity indices utilizing a multivariate model. AFHRL-TR-71-16, AD-729 763. Lowry AFB, CO: Technical Training Division, April 1971. Project 1121. NTIS.** This study demonstrates and discusses a new procedure for performing item analysis which utilizes multiple discriminant analysis to establish efficiently and effectively an index of item validity. Application of this statistical technique to data derived from an attitude survey of three groups of students enrolled in technical training courses yielded the following results: It disclosed those stimulus items which were responsive enough to discriminate among criterion groups; it partitioned the total discriminatory power of the items into two homogeneous components; it yielded data for arriving at a special weighting scheme for scoring the final attitude form; and it located the positions of the criterion groups relative to the two orthogonal dimensions of the attitude universe. (5 pp.)

148 **Taylor, J.N., & Black, D.E. Assignment of non-prior-service college graduate airmen. AFHRL-TR-71-17, AD-728 624. Lackland AFB, TX: Personnel Division, January 1971. Project 6323. NTIS.** Amendments to the Selective Service Act passed in 1967 resulted in a substantial increase in Air Force accession of non-prior-service college graduate airmen. This study was conducted to determine if the assignments given this group related to their academic specialties. Data from a sample group of these airmen revealed that a majority had received assignments in which their academic training could be used. The sample studied was substantially weighted by airmen who entered under the Delayed Enlistment program. (9 pp.)

149 **Hill, J.W., & Goebel, R.A. Development of automated GAT-1 performance measures. AFHRL-TR-71-18, AD-732 616. Williams AFB, AZ: Flying Training Division, May 1971. Project 1123, Contract F41609-70-C-0041, Stanford Research Institute. NTIS.** This report describes a systematic search for flight parameters that correlate with pilot proficiency. The system for making psychophysical measurements of the parameters consists of a Link General Aviation Trainer (GAT-1) connected to a small on-line digital computer (LINC-8). The computer can simultaneously monitor eight flight variables and input pseudo-random command signals (rough air) to three GAT-1 flight variables. By using this small computer in conjunction with a second computer program for further processing, 266 flight parameters were measured for each of the 30 subjects (*Ss*) run through the experiment series. The parameters were means, standard deviations, correlations between variables, and compensatory tracking gains and phase shifts.

The experiment series consisted of four tasks of increasing difficulty: a holding task, a holding task with power changes, a five-part flight profile, and an ILS landing approach. First, an analysis of variance on each of the 266 variables was used to select the most important ones. Second, these selected variables were entered in a multivariate discriminant analysis to determine which contributed most to differences in pilot experience. Although between 10 to 15 variables sufficed for perfect separation of the *Ss* into the three experience groups from which they were chosen, 27 variables

significantly contributed to the separation. A single criterion variable, a linear weighted sum of these 27 flight parameters, is suggested as a measure of pilot proficiency. (33 pp.)

150 **Culclasure, D.F. Development of career motivational prediction and selection procedures. AFHRL-TR-71-19, AD-728 625. Lackland AFB, TX: Personnel Division, January 1971. Project 7719, Contract F41609-70-C-0032, Southwest Research Institute. NTIS.** This technical report constitutes a comprehensive review of the literature related to career motivation and selection procedures. It surveyed the reported techniques for measuring career motivation and interest which were used by 24 industrial firms, 14 personnel and management consulting organizations, 8 marketing research firms, and various governmental agencies. Toward an ultimate goal of identifying those who can be expected to elect to remain on active duty past their original date of obligation, each technique cited was evaluated for possible application as a means for screening applicants who are to be provided training that leads to commissions as Air Force officers. The survey failed to identify a predictive instrument which demonstrated a sufficiently high validity coefficient to be of practical value. Available evidence, however, suggested that a career motivation screening procedure could be developed with reasonable probability characteristics of moderate effectiveness in predicting career motivation. Such a procedure would employ (*a*) those portions of the Strong Vocational Interest Blank (SVIB) which have been shown to have moderate validity (0.25) for predicting Naval officer retention when scored with the Navy Officer Key, and (*b*) a revised version of the Importance-Possibility Scale investigated in its original form by Air Force psychologists. (76 pp.)

151 **Fitzgerald, J.A. Evaluation of an airborne audio-video recording system for aircraft equipped with head-up display. AFHRL-TR-71-20, AD-736 818. Williams AFB, AZ: Flying Training Division, May 1971. Project 1123, Contract F41609-70-C-0035, Conductron Corporation. NTIS.** Recent innovations in flying training, most notably the technique of audio-video recording, suggest a very promising approach to the training of fighter pilots. The objective of this project was to provide a low-cost, reliable audio-video recording system (AVRS) for aircraft equipped with Head-Up Display (HUD) that would be capable of recording both the external real world cues through the aircraft's forward windscreen as well as the symbology of the HUD projected on the aircraft's combining glass. The ultimate objective is a research program to assess audio-video recording in HUD-equipped aircraft as both a technique for improvement of training and as a tool for pilot proficiency assessment. Two A-7D aircraft were fitted with an AVRS constructed from low-cost, commercial equipment with a good record of reliability. The equipment was modified to make it compatible with the aircraft and its flight environment. The system proved capable of recording the symbology on the HUD, as well as resolving ground target at normal altitudes and slant ranges encountered in the training environment. Although the equipment is quite acceptable for the purpose intended, it was not concluded on the basis of this study that this particular engineering design would be satisfactory for fleet-wide retrofit. Deficiencies that are acceptable for a research program might prove completely unacceptable for an operational system. (12 pp.)

152 **Taylor, C.W., Murray, S.L., Ellison, R.L., & Majesty, M.S. Development of motivation assessment techniques for Air Force officer training and education programs: motivation for pilot training. AFHRL-TR-71-21, AD-751 487. Brooks AFB, TX: Professional Education Division, July 1971. Project 1125, Contract F33615-69-C-1882, University of Utah. NTIS.** This study was an investigation into the relevance of motivational factors operating in various Air Force training programs, especially Air Training Command's Undergraduate Pilot Training program. The research project, as a whole, was directed toward understanding motivational factors as they distinguish those who drop out of training from those who successfully complete training. Investigation of the possible motivational factors behind voluntary elimination was designed to lead to (*a*) the development of a motivational screening device which would reduce the voluntary eliminees from Undergraduate Pilot Training as well as other Air Force programs; and (*b*) the development of an instrument which would

measure change in motivation as a result of Air Force training. This report serves to specify the overall project research design and to report results and conclusions reached in the first year of data collection. Two of the most interesting findings at this early stage of development are that some motivational component exists in both the self-initiated elimination (SIE) attrition criteria and the keys built to predict them, and, further, that the AFOQT already contains valid items that are not now being used but which can be scored for motivational screening purposes. Although the AFOQT is not now being scored for motivation, there seems to exist a potential for increased efficiency of predicting Self-Initiated Elimination (SIE). Empirical keying of AFOQT items and the most valid items developed in this study yielded promising results as a first step in the development of a motivation assessment technique. It is recommended that further research be done to more fully assess the impact of this initial investigation. (30 pp.)

153 **Askren, W.B., & Regulinski, T.L. Quantifying human performance reliability. AFHRL-TR-71-22, AD-727 766. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1124. NTIS.** Human performance reliability for tasks in the time-space continuous domain is defined and a general mathematical model presented. The human performance measurement terms time-to-error and time-to-error-correction are defined. The model and measurement terms are tested using laboratory vigilance and manual control tasks. Error and error-correction data are ordered and the underlying density functions isolated. The Weibull distribution is best fit for time-to-first-error data, and the Log-Normal distribution is best fit for time-between-errors and time-to-error-correction data. The normal distribution is rejected in all cases. Distribution parameter values are applied to the general mathematical model, and prediction made of human performance reliability for the tasks. It is also shown that task performance reliability improves with training on the tasks. (13 pp.)

154 **Chenzoff, A.P., Mallory, W.J., & Joyce, R.P. Guidance and specifications for the preparation of fully-proceduralized job aids for organizational and intermediate maintenance of electronic subsystems. AFHRL-TR-71-23, AD-731 144. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1710, Contract F33615-70-C-1500, Applied Science Associates, Inc. NTIS.** This report supplies a model for specifications for the preparation of fully proceduralized job aids for organizational and intermediate maintenance of electronic subsystems and offers guidance in the preparation of such aids. The aids to be developed from these specifications are for flight-line or field-shop maintenance of any electronic subsystem, and support the performance of the following maintenance functions, as needed: checkout, alignment, repair, adjustment, calibration, malfunction localization, malfunction isolation, and the removal and replacement of malfunctioning equipment items. (116 pp.)

155 **Lintz, L.M., Askren, W.B., & Lott, W.J. System design trade studies: the engineering process and use of human resources data. AFHRL-TR-71-24, AD-732 201. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1124, Contract F33615-70-C-1564, McDonnell Douglas Astronautics Company – East. NTIS.** The purpose of the study was to investigate the system design trade study process, and to determine the feasibility and effects of integrating data on the human resources of the Air Force in this process. Sixty-one completed trade studies from aeronautical, missile, and command and control systems were analyzed to determine the nature of engineering design trade studies. Four simulated trade studies representing flight control and avionics subsystems containing engineering and human resources data were constructed for experimental use. Seventy-two experienced design engineers performed the simulated trade studies. It was found that engineers can and do use human resources data in system design trade studies, and that such data should be presented in tabular form, in quantitative fashion and in units familiar to the engineer to be most useful. It was also found that there are four major sources of variability in trade study results, namely, choice of parameters to be included, weighting factors assigned to the parameters, methods of normalizing the parameter data, and methods of combining parameter data and weighting factors. Air Force standardization of trade study methods is recommended. (104 pp.)

156 **Valverde, H.H., Hicks, C.F., & Kearns, N.H. Development of an RF-4C refueling training program from computer-based systems data. AFHRL-TR-71-25, AD-736 409. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1710. NTIS.** This report describes the development of a systems approach to RF-4C air refueling training. The primary objective of the effort was to develop an instructional plan, or blueprint, using a format which facilitates the utilization of existing computer-based task data by training personnel. The training plan was developed for use by Tactical Air Reconnaissance Center instructor personnel in training RF-4C aircrews to effectively perform KC-135 air refueling requirements. Secondary program objectives were to demonstrate and refine the technology for developing other job-specific aircrew training programs using existing computer-based task data. The complete RF-4C air refueling training segment based on task and subtask behavioral objectives is appended. The objectives state the behavior required, the conditions under which the behavior is to be observed, and the standards which the behaviors should meet. (104 pp.)

157 **Colwell, M.C. TREES: a computer software system for processing data organized in branch form (an application to job performance aids). AFHRL-TR-71-26(I), AD-732 204. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1124, Contract F33615-70-C-1641, System Development Corporation. NTIS.** This document describes the development of computer programs for loading, editing, maintaining, and querying tree-structured data bases. Loading and maintaining data bases can be achieved interactively or in the batch mode. Querying and editing are done in the interactive mode only. A pre-requisite to the development of the computer programs was the development of tree-structured data base concepts. (32 pp.)

158 **Colwell, M.C., & Risk, D.M. TREES: a computer software system for processing data organized in branch form (an application to job performance aids). AFHRL-TR-71-26(II), AD-735 603. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1124, Contract F33615-70-C-1641, System Development Corporation. NTIS.** This report describes five computer programs which provide step-by-step guidance through tree-structured data files. Together, these five programs constitute TREES. The five programs are: (1) QUERY – for interacting with a tree-structured data base from a remote terminal; (2) BUILD – for loading data from a remote terminal; (3) EDIT – for editing and modifying existing data bases from a remote terminal; (4) BUMP – for loading and maintaining data bases in the batch mode; and, (5) LOADSS – for loading and maintaining standard statements in a batch mode. This Volume is intended for programmers who may wish to apply, expand, or revise any of the features of the TREES Computer Programs. Volume I of this report describes the design and development of TREES. (90 pp.)

159 **Colwell, M.C., Risk, D.M., & Reed, L.E. TREES user's guide – a computer software system for handling information in branch form. AFHRL-TR-71-27, AD-732 209. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1124, Contract F33615-70-C-1641, System Development Corporation. NTIS.** Instructions are presented for interactive and batch computer programs that process tree structured (TREES) data. These instructions were prepared as part of an overall effort to develop techniques for a computer based job performance aid. The QUERY program, which operates from a remote computer terminal, provides step-by-step guidance through maintenance troubleshooting trees. Data files may be created and maintained from a remote terminal using programs BUILD and EDIT, respectively. Large data bases are stored and maintained with program BUMP and standard phrasing of text material is stored in the data base with program LOADSS. Instructions for the interactive programs were prepared so that an individual with little or no computer experience may create, modify, and query his own data base. Keypunching instructions are given for the batch processing programs. The five programs have sufficient flexibility for application to many forms of tree-structured data, including flow diagrams, instructional material, or any other forms in which step-by-step guidance is needed through decision points. (125 pp.)

160 **Vitola, B.M., Massey, I.H., & Wilbourn, J.M. Development and standardization of the Airman Qualifying Examination–Form J. AFHRL-TR-71-28, AD-730 592. Lackland AFB, TX: Personnel Division, May 1971. Project 7719. NTIS.** A new form of the Airman Qualifying Examination (AQE-J) was developed and standardized for implementation in July 1971. The test replaces AQE-66 in the Air Force's selective recruiting program. Descriptive data and statistical characteristics of AQE items and subtests are presented, as well as intercorrelations among Project TALENT tests and AQE variables. AQE-J was formatted to present homogeneous items in blocks, thereby taking into consideration the examinee's mental set. The changes incorporated in the test should allow for more efficient administration, scoring, and gathering of biographical data; further, research data should be more readily accessible. (9 pp.)

161 **Vitola, B.M., & Valentine, L.D., Jr. Characteristics of Air Force enlistees related to draft vulnerability. AFHRL-TR-71-29, AD-730 593. Lackland AFB, TX: Personnel Division, June 1971. Project 7719. NTIS.** Although the Air Force has relied on voluntary enlistments to maintain its force strength, it is recognized that a major portion of first-term airmen are motivated to enlist by the prospect of being drafted. On the basis of draft vulnerability, the accessions for 1970 were categorized into four groups defined in terms of draft pressure. These groups, designated as high, moderate, and low draft-pressure and draft non-elibible, were compared on various dimensions. Compared to the other groups, the aptitude test performance of the low-pressure group was low. There were significant differences between the draft non-eligible group, the other groups, and the total sample. In all comparisons on test performance, there were marked differences between racial subgroups, but only moderate differences within draft-pressure groups. The data suggest that, under a reduced draft or zero-draft conditions, manpower resources at the higher aptitude levels will be more limited than presently is the case. (12 pp.)

162 **Lecznar, W.B. Three methods for estimating difficulty of job tasks. AFHRL-TR-71-30, AD-730 594. Lackland AFB, TX: Personnel Division, July 1971. Project 7734. NTIS.** The exploratory study using a job inventory developed for the Medical Materiel Career Ladder is concerned with a simple evaluation of three methods for estimating the difficulty of tasks: (*a*) rating on a relative scale; (*b*) rank ordering; and (*c*) computing an index from average grade of job incumbents performing each task. The data suggest the rating approach is one to be preferred although some additional questions arose concerning possible effects of task wording on variability across judges, or raters. (5 pp.)

163 **Boldt, R.F. A simple confidence testing format. AFHRL-TR-71-31, AD-737 113. Lowry AFB, CO: Technical Training Division, July 1971. Project 1121, Contract F41609-70-C-0044, Educational Testing Service. NTIS.** This paper presents the development of scoring functions for use in conjunction with standard multiple-choice items. In addition to the usual indication of the correct alternative, the method requires that the examinee indicate his personal probability of the correctness of his response. Both linear and quadratic polynomial scoring functions are examined for suitability. Unique quadratic scoring functions are found such that a score of zero is assigned when complete uncertainty is indicated. Futhermore, the examinee can expect to do best if he reports his personal probability accurately. A table of simple integer approximations to the scoring function is supplied. (6 pp.)

164 **Echternacht, G.J. Use of confidence testing in objective tests. AFHRL-TR-71-32, AD-734 031. Lowry AFB, CO: Technical Training Division, July 1971. Project 1121, Contract F41609-70-C-0044, Educational Testing Service. NTIS.** The development of confidence testing as a form of objective testing was traced from Hevner's initial format to that developed in recent years. Confidence testing has been used in varying forms over the past forty years as a method for increasing the amount of information available from objective test items. This paper traces the development of the procedure from Hevner's beginning method up to the various methods in use today. The term confidence testing

is applied to both probabilistic testing and confidence weighting procedures. Various procedures are presented, and their relationship with personality factors is discussed. (11 pp.)

165 **Echternacht, G.J., Sellman, W.S., Boldt, R.F., & Young, J.D. An evaluation of the feasibility of confidence testing as a diagnostic aid in technical training. AFHRL-TR-71-33, AD-734 032. Lowry AFB, CO: Technical Training Division, July 1971. Project 1121, Contract F41609-70-C-0044, Educational Testing Service. NTIS.** This report describes a study to determine the feasibility and the cost-effectiveness of using confidence testing as a diagnostic aid in technical training programs. Two types of confidence testing, Pick-One and Distribute 100 Points, were developed for comparison to conventional multiple-choice testing. The study was carried out in two technical training courses, Aerospace Ground Equipment Repairman (AGE) and Jet Engine Mechanic (JEM), currently being taught at Chanute Air Force Base, Illinois. The criteria for feasibility included end of block examination scores, number of student remediational sessions, and both student and instructor attitudes. In addition, the relationship of various personality variables to confidence test scores was examined for both types of confidence testing. The major finding was that while scoring was somewhat more time consuming, end of block examination scores improved slightly and the number of remediations required declined slightly when either confidence testing method was employed. Other areas of investigation produced essentially null results. (127 pp.)

166 **Echternacht, G.J., Boldt, R.F., & Sellman, W.S. User's handbook for confidence testing as a diagnostic aid in technical training. AFHRL-TR-71-34, AD-731 192. Lowry AFB, CO: Technical Training Division, July 1971. Project 1121, Contract F41609-70-C-0044, Educational Testing Service. NTIS.** This handbook is intended to supply both testing specialists and general users of tests with a set of instructions for implementing a program of confidence testing in technical training situations, provide information concerning such factors as the identification of promising areas of application, the relative value and ease of alternative scoring methods, techniques for evaluating confidence information, and administrative considerations. It contains a discussion of Pick-One and Distribute 100 Points confidence formats, other confidence procedures, and the relative merits of each method, selection and confidence test scale scores, uses of confidence testing, and instructions for those administering confidence tests where either hand or machine scoring is used. (37 pp.)

167 **Morgan, R.L. Implications of training research for CAI. AFHRL-TR-71-35, AD-733 339. Wright-Patterson AFB, OH: Advanced Systems Division, August 1971. Project 1710. NTIS.** A brief description is provided of five general implications of prior training research for contemporary efforts to exploit computers for training. Stated negatively, or as cautions, these five general implications are: 1. Don't act as if computer – based training were something entirely new. Always conceive of computer – based training in such a way that you can relate it to what is known about conditions for effective training. 2. Don't be misled into thinking that a computer offers a training system which is obviously so superior that no evaluation need be made or records kept. 3. Don't just apply the computer to training. Carefully analyze the total training process and apply the computer to those functions that need automation. 4. Don't be seduced by claims that, almost mysteriously profound learning and understanding occur when a trainee "uses a computer to intereact heuristically with the subject-matter." Systematic practice with feedback is still the best condition for learning. 5. Don't put all your 'eggs' in any one type of research and development 'basket.' Because of high investment costs and other factors, such as market position, there seems to be a somewhat unhealthy emphasis on an immediate capability. (6 pp.)

168 **Andersen, D.O., & Hagin, W.V. What's new on the training horizon? AFHRL-TR-71-36, AD-727 009. Williams AFB, AZ: Flying Training Division, March 1971. Project 1123. NTIS.** Jet flying training is costly and takes a long time. Flying training has always been essentially a "learn by do" operation. This paper describes new training technologies. It documents the potential of these technologies and simple and complex ground trainers for vastly improving both the quality and efficiency of pilot training. (23 pp.)

169 **Federico, P.A. Evaluating an experimental audio-visual module programmed to teach a basic anatomical and physiological system. AFHRL-TR-71-37, AD-734 030. Lowry AFB, CO: Technical Training Division, July 1971. Project 1121. NTIS.** This study evaluated the learning efficiency and effectiveness of teaching an anatomical and physiological system to Air Force enlisted trainees utilizing an experimental audio-visual programmed module and a commercial linear programmed text. It was demonstrated that the audio-visual programmed approach to training was more efficient than and equally as effective as the programmed text approach to training. It was determined that trainees of different learning abilities acquired as much knowledge about the digestive system from viewing the 20-minute audio-visual module as from interacting for 80 to 120 minutes with the programmed text. It was established that students who differed in their mastery of the rudiments of anatomy, physiology, and medical terminology performed equally well after audio-visual instruction or after written programmed instruction. It was found that trainees reported more positive reactions to the audio-visual program than to the written program. It was recommended that within the Medical Service Fundamentals Course audio-visual programmed instruction be emphasized and written linear programmed instruction be de-emphasized. (25 pp.)

170 **Smith, E.A. Use of portable video recorders as an instructional system development tool. AFHRL-TR-71-38, AD-737 114. Lowry AFB, CO: Technical Training Division, July 1971. Project 1121. NTIS.** This report proposes that small portable video tape recorders can be employed effectively and economically as a "scratch pad" during course development. Doing so facilitates the Instructional System Development approach. Current off-the-shelf equipment can be used for data gathering during the analysis of system requirements. It can be very advantageous in obtaining clear and concise definition of training requirements. This same equipment can be employed for initial development of the course objectives and the test materials. During this phase it has proven particularly beneficial in revealing enabling objectives that might otherwise be overlooked, developing a logical presentation without extraneous material, establishing definable objectives, and encouraging the inclusion of self-evaluation and confirmation as an integral part of the learning process. During the development and validation stages, the equipment can be used for initial scripting, for editing and re-editing, for obtaining content approval, and for individual tryout by students. During these activities, video enables the development of material through the evolution of many revisions prepared quickly and easily with a minimum of interference with the developmental activity by delays due to requirements for outside technical assistance. Finally, the techniques enable the course writers to obtain a viewable end product before they have to commit themselves on the media to be used. The video tapes can then be used as the draft or shooting script for the development of the manual, motion picture, or prenarrated slide sequence. The major criterion is that equipment be available that can be used by system designers with a minimum of interruption of their creative endeavors. While it is recommended that video recordings be used during the development of training sequences, it is not advocated that they be used for presentations in the classroom. Rather, conversion of the training material to manuals, prenarrated slide sequences, or movies is advocated. (7 pp.)

171 **Shriver, E.L., Mills, G.M., Harris, C.M., & Carswell, W.A. Guide to defining and solving waiting line problems: procedures. AFHRL-TR-71-39(I), AD-738 320. Wright-Patterson AFB, OH: Advanced Systems Division, June 1971. Project 1124, Contract F33615-70-C-1797, URS/Matrix Research Company. NTIS.** This guide is designed to present techniques for the solution of queuing problems in a form for use by the nonmathematician. It is believed that effective use of these techniques will provide considerable savings in those job areas where waiting time is a costly factor. The guide consists of a series of questions that may be directed toward any queuing problem at hand. The answers to these questions will lead the reader in the direction of a solution or resolution of a problem. The mathematics beyond arithmetic normally required by such problems has been reduced to graphical form. These graphs can be used for most values encountered in a common queuing

problem. Additional descriptive material is included in the text which explains these types of queuing problems that this guide does not address, and provides an indication of how such problems might be simplified and how approximate solutions might be reached. This guide is directed toward the common, job-oriented problems and leaves the special cases for more advanced texts. (184 pp.)

172 **Mills, G.M., Shriver, E.L., Carswell, W.A., & Harris, C.M. Guide to defining and solving waiting line problems: sample problems. AFHRL-TR-71-39(II), AD-736 032. Wright-Patterson AFB, OH: Advanced Systems Division, July 1971. Project 1124, Contract F33615-70-C-1797, URS/Matrix Research Company. NTIS.** Volume II of this guide contains 71 sample problems pertaining to Air Force operations, maintenance, base administration, supply, and transportation. The step-by-step procedure for solving each problem with queuing techniques presented in Volume I is illustrated. (376 pp.)

173 **Sanders, J.H., Jr., Valentine, L.D., Jr., & McGrevy, D.F. The development of equipment for psychomotor assessment. AFHRL-TR-71-40, AD-732 210. Lackland AFB, TX: Personnel Division, July 1971. Project 7719, Contract F41609-70-C-0015, BioTechnology, Inc. NTIS.** The purpose of this work was to develop a highly flexible psychomotor testing system capable of reproducing the psychological task structure of two electromechanical tests used earlier in Air Force pilot selection programs. These were the SAM Complex Coordination Test and the SAM Two-Hand Coordination Test. The work was conducted in two phases, the first of which resulted in the definition, design, assembly, and testing of the psychomotor testing system. The second phase involves the testing of 120 Air Force pilot candidates and analysis of the data. The system developed to implement these tests consists of two test stations (expandable to eight) and a test control unit. Test control station functions are performed with a PDP-8/L digital computer which can generate graphical, alphanumeric, or point displays on a direct-view storage tube. The feasibility of this psychomotor testing system was demonstrated. It was found to be highly flexible and efficient, with a capability for conducting test sessions under automated conditions. (11 pp.)

174 **Nagler, A.H., & Mazurkewitz, A.R. Wide angle, infinite depth-of-field optical pickup for visual simulation. AFHRL-TR-71-41, AD-892 433. Wright-Patterson AFB, OH: Advanced Systems Division, November 1971. Project 6114, Contract F33615-68-C-1456, Farrand Optical Co., Inc., NTIS.** During Phase I of the program, a study was undertaken to establish the most favorable approach toward producing a wide-angle, infinite depth-of-field, inclined-image plane viewing probe for purposes of simulation. The second phase involved fabrication, test and evaluation of an engineering feasibility model of such a device. This report describes both phases of the program. Previous optical pickups for flight simulators were limited by slant range focus at close approaches to a model. Obtaining closer approaches has important size, cost and versatility advantages in making simulator terrain models and support equipment. Phase I study results indicated the feasibility of producing a 140° circular field pickup with full pitch capability and a close approach of 4.1 mm. A preliminary but realistic design was developed and evaluated. The design approach was confirmed by photographing a runway model with a modified 110° probe. Other concepts examined that had promise of improving resolution were dual sensor outputs and dual relays. Component trade-offs, simplifications, and techniques were sufficiently developed for the design and fabrication phase of the program to proceed directly. The Phase II design, fabrication and test program resulted in an engineering model that essentially met all of the design goals of the program. The probe system was evaluated numerically and photographically, working to an altitude of 0.2 inches. It has full functional operation in a static form and can readily be reworked to dynamic operation if desired. (86 pp.)

175 **Grausnick, R.R., & Kottenstette, J.P. A performance evaluation: microfiche versus hardcopy. AFHRL-TR-71-42, AD-734 740. Lowry AFB, CO: Technical Training Division, May 1971. Project 1121, Contract F41609-70-C-0040, University of Denver. NTIS.** The primary purpose of the present study was to replicate an experiment previously conducted by Baldwin and Bailey (1971) in order to

establish the reproducibility of their results in a different user environment. Twelve psychometric instruments employing technical training materials which required various types of visual skills were used in the testing. Three forms of each test exercise were reproduced: hardcopy, positive-image microfiche, and negative-image microfiche. Ninety subjects were randomly assigned to one of three experimental groups (hardcopy, positive-image, and negative-image). An analysis of variance (Winer, 1962; Myers, 1966) revealed F values to be significant beyond the .01 level for Test 4, Figure Identification; Test 6, Symbol Translation; Test 7, Graphs; Test 8, Tables; and Test 12, Number Verification; and beyond the .05 level for Test 5, Length Estimation. No significant differences in performance were found between positive and negative-image microfiche presentations. These results generally substantiate those reported by Baldwin and Bailey. Further analyses demonstrated that the reader presentation primarily affected the speed at which the subjects worked while accuracy was not differentially affected by the presentation mode. An analysis of the performance of subjects grouped according to Armed Forces Qualification Test (AFQT) scores indicated that various intelligence groups were differentially affected by the mode of presentation. While statistical differences were found in a number of test exercises, no fundamental difficulties were encountered which would bar future utilization of microform materials in technical training programs. (51 pp.)

176 **Grausnick, R.R., West, A.S., & Kottenstette, J.P. Microform use in a technical training environment—an experiment. AFHRL-TR-71-43, AD-733 686. Lowry AFB, CO: Technical Training Division, May 1971. Project 1121, Contract F41609-70-C-0040, University of Denver. NTIS.** This phase of the research in technical training microform applications explores the comparative advantages and disadvantages of microform in classroom training applications. A 30-hour instructional sequence entitled, "Basic Computer Operation" was selected from an on-going course at the 3750th Technical Training School, Sheppard Air Force Base, Wichita Falls, Texas. A two-stage filming procedure was used to convert the training manual used in the instructional sequence to an innovative microform format in both positive and negative film polarities. The major result of this comparative analysis is that Air Force trainees can and did use the microform systems effectively and intensively over a one-week period. No significant performance decrements were encountered in the experimental classes. This study also examines a number of important considerations involved in utilizing microforms for training purposes, including the impact of microform use on instructional routine, administrative-logistics considerations, and student study habits. A personal reader is recommended for its positive values in classroom use, student residence use, and logistics. The significant accomplishments of this study were the demonstration of the feasibility of the microform medium for classroom instruction and the development of an effective, innovative format which utilizes the unique presentation characteristics of microform to facilitate instructional communication. (68 pp.)

177 **Kottenstette, J.P., Morrison, A.B., West, A.S., & Grausnick, R.R. A guide to instructional uses of microform. AFHRL-TR-71-44, AD-734 741. Lowry AFB, CO: Technical Training Division, May 1971. Project 1121, Contract F41609-70-C-0040, University of Denver. NTIS.** This Guide presents information on the use of microforms in a training environment; to provide basic background on microforms as a distinct communications medium; and to illustrate the steps required in operationalizing the use of microforms in a training sequence.

A review of the material to be presented resulted in the preparation of three chapters for the instruction of individuals requiring an understanding of the subject: (1) general information on microforms to include definitions and explanations of terms, materials, and concepts; applications and acceptance; new techniques and processes; costs; and information sources (2) the use of microforms in a direct instructional mode and the relationships of microform capabilities to training applications; and (3) the considerations to be taken into account in any specific instructional application, which include a plan for instructional materials, a plan for delivery, and a plan for use; as well as an outline for design and implementation of such an operation. (80 pp.)

178 **Shenk, F., & Wilbourn, J.M. Officer attitudes related to career decisions. AFHRL-TR-71-45, AD-744 038. Lackland AFB, TX: Personnel Research Division, December 1971. Project 7719. NTIS.** The present study is a reexamination of survey data obtained in 1964, which have been updated against a current criterion of active duty versus separated from the service. The initial study was undertaken to examine factors related to the career intent of officers with limited commissioned service. At that time, the USAF Training and Utilization Survey was designed and administered to a 20-percent sample of all officers with less than seven years of military service. For the current study, subjects having less than 12 months of active duty at the time the survey was administered were omitted. Criterion data were obtained for 4,006 subjects. These subjects were further subdivided into various subgroups to account for differences in source and type of commission. The overall retention rate was 65 percent for this sample; however, there were differences in the various subgroups. Examination of the stated career intention of these subjects suggested that those who had a definite positive or negative attitude toward a military career were fairly consistent in their intent and actual decision. The overall correlation between the stated career intent and the criterion was .56. Job characteristics or rewards were also examined. In general there was little or no relationship between the importance of a reward and the attainability of that characteristic. (19 pp.)

179 **Guinn, N., Alley, W.E., & Farmer, C.B. Impact of an all-volunteer force on AFROTC officer procurement. AFHRL-TR-71-46, AD-741 746. Lackland AFB, TX: Personnel Research Division, December 1971. Project 7719. NTIS.** As the armed forces consider the feasibility of implementing an all-volunteer force, it becomes necessary to determine the impact of such a move on officer accessions. A representative sample of AFROTC advanced cadets were surveyed and categorized into groups based on draft vulnerability and expressed attitude toward officer training in the absence of the draft. Results indicate that AFROTC cadet enrollments are motivated to some extent by draft pressure. In comparisons made between self- and draft-motivated cadets, statistically significant differences were found on demographic, aptitudinal, and attitudinal variables. (11 pp.)

180 **Juhlin, J.A. Study to define the interface and options for the advanced simulation in undergraduate pilot training visual simulator. AFHRL-TR-71-47, AD-739 585. Wright-Patterson AFB, OH: Advanced Systems Division, September 1971. Project 1192, Contract F33615-71-C-1211, General Electric Company. NTIS.** As a result of recent Air Force decisions regarding the Advanced Simulation in Undergraduate Pilot Training (ASUPT) Flight Simulator requirements and configurations, the need for additional definition of the visual subsystems interface parameters became apparent. It was also recognized that certain new features to improve the system operational flexibility and performance needed further study and definition.

In the study to define the interface and options for the ASUPT visual simulator, four major areas were investigated. These specific areas are: a. CRT Electronics Definition, b. CRT Electrical Characteristics, c. Display Multiplexing,and d. Edge Smoothing. The CRT Electronics Definition and the CRT Electrical Characteristics investigations concentrated on establishing feasible design parameters consistent with system performance requirements and on identifying a compatible interface between the CRT (including focus and deflection coils) and the Display Electronics. The CRT Electronics Definition included sweep generator and deflection amplifiers, linearity correction circuits, and dynamic brightness as well as focus circuits, video amplifiers, and power supplies. The Display Multiplexing and Edge Smoothing investigations were directed toward concept definition of optional features to improve the system operational flexibility and performance.

The Display Multiplexing investigation resulted in the definition of two approaches for driving two cockpit displays with one image generator referred to as Time Multiplexing and Edge Capacity Multiplexing. In the Time Multiplexing concept, the computed image generator alternately updates each cockpit display subsystem resulting in a reduction of the update rate from 30 updates per second to 15 updates per second while still refreshing the 2:1 interlaced display at 30 times per

second to prevent flicker. The edge capacity concept shares the system scene content capacity in each cockpit display. The subjective evaluation of motion discontinuities associated with the reduced update rate inherent in time multiplexing demonstrated that severe operational constraints would be imposed if this technique were implemented. The Edge Smoothing study evaluated several techniques for improving the discontinuities in edges intersecting the raster lines at angles other than 0 to 90 degrees. The results of this study indicate that when all the techniques are simultaneously applied, the residual effect is negligible. (140 pp.)

181 **Christal, R.E. Stability of consolidated job descriptions based on task inventory survey information. AFHRL-TR-71-48, AD-734 739. Lackland AFB, TX: Personnel Research Division, August 1971. Project 7734. NTIS.** This study was designed to determine the stability of data reported in consolidated job descriptions computed from task inventory survey returns. It was found that the vectors "percent performing" and "percent time spent by total group" are highly stable, even for relatively small samples. Split-half reliability coefficients were generally in the middle and upper 90's. (2 pp.)

182 **Goebel, R.A., Baum, D.R., & Hagin, W.V. Using a ground trainer in a job sample approach to predicting pilot performance. AFHRL-TR-71-50, AD-741 747. Williams AFB, AZ: Flying Training Division, November 1971. Project 1123. NTIS.** This report documents a novel application of the "job sample" approach to screening candidates for Air Force Undergraduate Pilot Training. The job sample approach consists of obtaining work samples during early training or simulating work situations prior to training and deriving measures of performance from either for use as predictors of future job success. Two specially instrumented and slightly modified Link GAT-1 trainers (General Aviation Trainer for single engine, propeller driven aircraft) were used to present incoming students with two types of tasks: tracking tasks and aircraft maneuvers. Several classes of data, (*e.g.*, tracking measures, maneuvers measures, GAT-1 instructor pilot grades, were generated. Criterion data were check ride grades. Three important findings emerged: (*a*) The concept of job sampling for screening purposes appears to be valid and should be vigorously pursued; (*b*) the T-41 continues to predict subsequent performance in jet pilot training; and (*c*) the ground trainer is a useful vehicle for predicting pilot success and should be given further study to assess its proper role in jet pilot screening. (16 pp.)

183 **Askren, W.B., & Korkan, K.D. Design option decision trees: a method for relating human resources data to design alternatives. AFHRL-TR-71-52, AD-741 768. Wright-Patterson AFB, OH: Advanced Systems Division, December 1971. Project 1124. NTIS.** The feasibility of predetermining the design options available to the engineer during system design and placing the results in a decision tree format was investigated. Design option decision trees for propulsion and flight control subsystems were developed. The decision trees were evaluated by eight engineers experienced in designing the specialized areas of aerospace systems. It is concluded that the decision format is a feasible and valid method for describing system design options. It is hypothesized that Design Option Decision Trees may provide a means for relating human resources data to specific design characteristics. However, a number of additional investigations are needed to develop and validate a workable technique for using DODT's as a method for including human resources data in design decisions. (27 pp.)

184 **Folley, J.D., Jr., Joyce, R.P., Mallory, W.J., & Thomas, D.L. Fully proceduralized job performance aids: draft specification for organizational maintenance. AFHRL-TR-71-53(I), AD-740 903. Wright-Patterson AFB, OH: Advanced Systems Division, December 1971. Project 1710, Contract F33657-70-C-0279, Applied Science Associates, Inc. NTIS.** This report supplies a model for specifications for the preparation of Fully Proceduralized Job Performance Aids for the organizational maintenance of Air Force man-machine systems. The model reflects the research findings of

AFHRL and other DoD agencies concerning maintenance data. It has the unique feature of requiring that certain subproducts necessary for the development of this type of data be prepared in a standard format and submitted for review by the procuring agency. These subproducts include items such as a task identification matrix, task inventory, a task description index and management matrix, and task step data details. The aids to be developed from these specifications are for the *organizational* maintenance of any man-machine system and support the performance of the following maintenance functions: checkout, alignment, repair, adjustment, calibration, malfunction isolation and the removal and replacement of malfunctioning equipment items. It calls for the preparation of the aids in several options of job guide format. (116 pp.)

185 **Folley, J.D., Jr., Joyce, R.P., Mallory, W.J., & Thomas, D.L. Fully proceduralized job performance aids: developer's handbook. AFHRL-TR-71-53(II), AD-744 007. Wright-Patterson AFB, OH: Advanced Systems Division, December 1971. Project 1710, Contract F33657-70-C-0279, Applied Science Associates, Inc. NTIS.** This report provides guidance for the development of fully proceduralized job performance aids for the organizational maintenance of Air Force man-machine systems. It contains detailed instructions for preparing fully proceduralized job performance aids in accordance with the requirements of the draft specification contained in Volume I of this technical report. It includes instructions for performing the behavioral task analysis and for converting the results of the analysis into effective performance aids. In addition, it presents a strategy and guidance for developing supervised practice exercises designed to produce the skills required to prepare fully proceduralized job performance aids. (198 pp.)

186 **Joyce, R.P., Folley, J.D., Jr., & Elliott, T.K. Fully proceduralized job performance aids: JPA manager's handbook. AFHRL-TR-71-53(III), AD-744 817. Wright-Patterson AFB, OH: Advanced Systems Division, December 1971. Project 1710, Contract F33615-71-C-1644, Applied Science Associates, Inc. NTIS.** This report provides guidance for the Air Force Data Managers charged with the responsibility for the procurement of fully proceduralized JPAs. It provides guidelines, suggested procedures, and checklists for use by data managers in the review and assessment of the subproducts, intermediate products and JPAs produced in accordance with the draft specification contained in Volume I of this technical report. (76 pp.)

187 **Christal, R.E. Analysis of racial differences in terms of work assignments, job interest, and felt utilization of talents and training. AFHRL-TR-72-1, AD-741 758. Lackland AFB, TX: Personnel Research Division, January 1972. Project 7734. NTIS.** First-term Black airmen were compared with first-term Non-Blacks in 11 career ladders in terms of their work assignments, job interests, and felt utilization. The unique contribution of race in accounting for the number of tasks assigned and for the average difficulty level of tasks performed per unit time was not significant in any of the ladders. Race did make a unique contribution in predicting an overall job difficulty index in two ladders, but in each instance this contribution was less than one percent. There appeared to be no practical differences in the types of assignments given to Blacks and Non-Blacks within the 11 ladders investigated. Blacks in the 291X0 Communications Center and 702X0 Administrative ladders reported a higher level of job interest and a higher feeling of utilization. Again, these differences were significant, but were relatively small. (6 pp.)

188 **Judy, R.W., Levine, J.B., Russell, R., Van Wijk, A.P., & Wolfson, W. A conceptual design for the cost evaluation of alternative educational systems in managing the Air Force Academy and Air Force ROTC. AFHRL-TR-72-2, AD-770 746. Brooks AFB, TX: HQS Air Force Human Resources Laboratory, September 1973. Project 1125, Contract F41609-71-C-0037, Canadian Commercial Corp. NTIS.** This document contains detailed designs of two models customized to the management needs of the U.S. Air Force Academy and the Air Force ROTC. The model, upon implementation, would permit administrators to obtain answers to various "what if . . ." management questions. The design of these models was based on a situation analysis of the U.S. Air Force Academy and the Air

Force ROTC and a state-of-the-art analysis of existing educational cost models. No solution was attempted for the difficult problem of obtaining good measures of the effectiveness of educational systems: these are resource requirements prediction models. This effort has produced customer participation and acceptance; implementation is for the future. (176 pp.)

189 **Bergman, B.A., & Siegel, A.I. Training evaluation and student achievement measurement: a review of the literature. AFHRL-TR-72-3, AD-747 040. Lowry AFB, CO: Technical Training Division, January 1972. Project 1121, Contract F41609-71-C-0025, Applied Psychological Services, Inc. NTIS.** The current training evaluation and student measurement literature is reviewed. The emphasis is on studies which have been reported in the last ten years, although earlier studies which have impacted heavily on recent trends are also included. Because of the obvious interaction between both training evaluation and student measurement, on the one hand, and such topics as statistical methods, methods for course development, training methods, learning styles, motivation, and moderator variables, on the other hand, these and similar considerations are also included. (57 pp.)

190 **Welde, W.L., & Cream, B.W. Variables influencing the perception of flicker in wide angle CRT displays. AFHRL-TR-72-4, AD-766 443. Wright-Patterson AFB, OH: Advanced Systems Division, December 1972. Project 1710. NTIS.** An experiment was conducted to determine the influence of three variables on the perception of the psychophysical phenomenon of flicker in wide angle CRT displays. The three independent variables treated in the experiment were: 3, 6, and 9 FL illumination levels; four images of which three were static and one was dynamic; and 26 fixation points positioned around a display from 0 to 120° in the horizontal axis and 60° down to 90° up in vertical axis. Recorded measures in the factorial experiment consisted of time to the first observation of flicker, percentage of the total numbers of trials that flicker was observed, and the severity of flicker regarding its interference with a visual task. Analysis of variance tests were applied to the experimental data. Conclusions drawn from the experiment are: (1) flicker will probably be encountered at all illumination levels between 3 and 9 FL; (2) the most prominent flicker effects will be encountered when fixating at a point 30° from the source of illumination with flicker being observed out to 120° horizontally and to +90°/−60° vertically; (3) the severity with which flicker interferes with a primary visual task is not expected to exceed a noticeable to moderate level of distraction; (4) subject differences are considerable in the perception of flicker, but each individual is fairly consistent in his sensitivity to flicker; (5) some individuals are prone to experiencing spatial disorientation when the display system presents a moving image, and further research is recommended on this phenomenon. (69 pp.)

191 **Vitola, B.M., & Alley, W.E. Characteristics of 18-year-old enlistees who enter the Air Force before becoming draft-eligible. AFHRL-TR-72-5, AD-744 039. Lackland AFB, TX: Personnel Research Division, February 1972. Project 7719. NTIS.** While it is recognized that the major portion of all first-term enlistees are strongly motivated to enter the service as a function of their draft vulnerability, a large percentage of young men enlist in the United States Air Force before they become subject to the draft. In this study, 18-year-old enlistees, born in 1951, who entered the Air Force after July 1, 1970 (the day on which they received their draft lottery number for 1971), were categorized into three groups defined in terms of their probable vulnerability for the 1971 draft (i.e., high, moderate, and low vulnerability). In general, the data suggest that enlistment of the 18-year-olds in 1970 was related to their status in the 1971 draft lottery. Further, comparisons on education, race, and aptitude test performance revealed patterns similar to those found in a study of 19-through-26-year-old airmen categorized by draft vulnerability. Implications of the findings for an all-volunteer force include an expected decrease in the educational and aptitude levels of enlistees, a greater difficulty in filling high-aptitude enlistment quotas, and an increase in the proportion of Negro enlistees. (11 pp.)

192 **Knoop, P.A., & Welde, W.L. Automated pilot performance assessment in the T-37: a feasibility study. AFHRL-TR-72-6, AD-766 446. Wright-Patterson AFB, OH: Advanced Systems Division, April 1973. Projects 6114, 1710. NTIS.** Research was conducted to develop a capability for quantification and assessment of in-flight pilot performance for utilization in Undergraduate Pilot Training (UPT). This feasibility effort was directed to overcoming the disadvantages of the traditional subjective rating of a pilot trainee's performance by the instructor pilot. This was accomplished through the development of an automated, objective performance measurement system that possesses the characteristics of reliability, validity, and sensitivity. A T-37B was instrumented to digitally record 24 flight and engine parameters. An extensive computer software system was developed with which to reduce, calibrate, and analyze the recorded data from the lazy 8 and barrel roll maneuvers, and compute performance measures. Criterion values for the two maneuvers were developed by utilizing task analysis data, narrative descriptions, and recorded in-flight maneuver performance of a highly qualified Air Training Command instructor pilot. Utilizing recorded data from 16 students and 4 instructors, experimental performance measures were derived through an interactive analytic approach. Study results indicated that lazy 8 performance assessment can be accomplished using the flight parameters of roll angle, pitch angle, and airspeed in a single summary error measure. Barrel roll measurement is dependent upon roll and pitch angle, acceleration (g force), and roll rate. A definite relationship between roll and pitch was determined to be critical to measurement. Discussions of measurement validation methods, debriefing plots, a sampling rate study, instrumentation techniques, and problem areas are provided. (463 pp.)

193 **Gould, R.B. Reported job interest and perceived utilization of talents and training by airmen in 97 career ladders. AFHRL-TR-72-7, AD-745 099. Lackland AFB, TX: Personnel Research Division, January 1972. Project 7734. NTIS.** The purpose of this study was to investigate the extent of differences in reported job satisfaction of over 100,000 airmen in 97 career ladders. The differences between career ladders and between individuals within career ladders were evaluated. Two seven-point scales measuring incumbents' job interest and feelings of how well their jobs make use of their talents and training have been included in inventories administered under the USAF Occupational Survey Program. Analyses of the responses indicated that while most airmen found their jobs interesting and felt well utilized, there were some extreme differences between career ladders and among individuals within ladders. Extensive ladder by ladder studies are warranted to identify factors relating to differences in job satisfaction. (10 pp.)

194 **Wood, M.E., Hagin, W.V., O'Conner, R., & Myers, D.W. Design of the simplified formation trainer. AFHRL-TR-72-8, AD-754 973. Williams AFB, AZ: Flying Training Division, March 1972. Project 1123, Contract F41609-71-C-0005, Goodyear Aerospace Corp. NTIS.** The analysis and design of a simplified, visual part-task formation trainer is described. Consideration is given to the rationale which supports a part-task approach for formation training and the basic psychophysical and training requirements of the formation task. Given detailed study of these variables, a specific model-TV trainer design is presented which effectively uses off-the-shelf technology to meet training needs at relatively low cost. (27 pp.)

195 **Semple, C.A., Jr., Heapy, R.J., Conway, E.J., & MacArgel, R.E. Navigator-observer utilization field flying specialties study final report. AFHRL-TR-72-10(I), AD-907 096. Williams AFB, AZ: Flying Training Division, April 1972. Project 1123, Contract F41609-71-C-0014, Manned Systems Sciences, Inc. NTIS.** The Navigator-Observer Utilization Field Flying Specialties Study was performed in the context of the Instructional Systems Development (ISD) approach. The study was designed to identify the future role and training requirements for Navigator-Observers through 1990. Objectives accomplished by the study were:

-Determine present and future roles of Navigator-Observers
-Identify and analyze operational task requirements

-Identify common and non-common operational tasks
-Develop training objectives based upon all tasks
-Validate present Navigator-Observer training requirements
-Identify further research and development requirements

Role information was used in the development of behavioral objectives for projected training tasks. Role information can also be used in policy decisions regarding future navigator training program design. Task and commonality analysis data formed the nucleus of the first computerized Navigator-Observer data base. Among the most important uses of such information are the development of trainee selection criteria, design of training tasks, curriculum design, selection of methods and media and development of detailed performance measures and tests. Training requirements in the form of behavioral objectives can provide the cornerstone for future Navigator-Observer training program design according to ISD. Approximately 80% of present Navigator-Observer training requirements were partially or fully validated by study derived data. Recommendations for follow-up studies are presented. (30 pp.)

196 **Semple, C.A., Jr., Heapy, R.J., & Conway, E.J. Navigator-observer utilization field flying specialties study, Appendix II: common and noncommon operational task requirements. AFHRL-TR-72-10(III), AD-907 097. Williams AFB, AZ: Flying Training Division, April 1972. Project 1123, Contract F41609-71-C-0014, Manned Systems Sciences, Inc. NTIS.** Appendix II presents information developed during Phase II of a three-phase study designed to provide a technical basis for determining future (1975-1990) navigator training requirements. The term navigator is used generally to refer to navigator (AFSC 1535), Radar Navigator (Navigator-Bombardier) (AFSC 1525). Weapon Systems Officer (AFSC 1555), and Electronic Warfare Officer (AFSC 1575). This appendix addresses the methodology which was developed and used to determine common and non-common operational task requirements across all navigator flying specialties, as well as within each flying specialty. Task description and analysis methods are presented along with data collection and validation procedures. Computer software developed for determining common and non-common tasks is presented. Rationale for deriving task commonality criteria is addressed. Supplementary Phase II classified task analysis and commonality analysis information is presented in a separate section (Section IX) of the secret Appendix I, entitled Present and Future Roles of the Navigator (U), in order to keep all classified information in a single document for control purposes. (99 pp.)

197 **Semple, C.A., Jr., Heapy, R.J., & Conway, E.J. Navigator-observer utilization field flying specialties study, Appendix III: development of training requirements. AFHRL-TR-72-10(IV), AD-907 098. Williams AFB, AZ: Flying Training Division, April 1972. Project 1123, Contract F41609-71-C-0014, Manned Systems Sciences, Inc. NTIS.** Appendix III presents information developed during Phase III of a three-phase study designed to provide a technical basis for determining future (1975-1990) navigator training requirements. The term navigator is used generally to refer to Navigator (AFSC 1535), Radar Navigator (Navigator-Bombardier) (AFSC 1525), Weapons Systems Officer (AFSC 1555), and Electronic Warfare Officer (AFSC 1575). This appendix addresses the methodology used for developing training Criterion Objectives, along with methodological problems encountered while developing the objectives. Resulting Criterion Objectives are presented. Results of comparing the Criterion Objectives with present course training standards for the purpose of validating present training requirements are presented. (109 pp.)

198 **Smith, J.F., & Flexman, R.E. An instructional manual for using performance record sheets designed for primary pilot training. AFHRL-TR-72-11, AD-739 190. Williams AFB, AZ: Flying Training Division, March 1972. Project 1123. NTIS.** Subjective techniques for measuring pilot performance have been used for many years in pilot training and have been demonstrated to be satisfactory for routine instructional usage. However, such methods are usually inadequate for use in pilot training research. The problem in using subjective judgments is that these ratings do not permit

finite discriminations and thus real differences between alternative training methods may be overlooked. The resultant erroneous findings may have significant impact on current and future training systems. The use of subjective criteria also tends to influence the selection of experimental designs and consequently, the study results. To circumvent some of these problems, research personnel developed a pseudo-objective performance scoring technique by providing various formats for performance record sheets (PRS's) on which instructor observers recorded required data. The first such system was used successfully some 20 years ago. The techniques used and experience gained in this project provided a basis for several subsequent successful research programs conducted in the USAF, Army, and FAA. One product of this first study was a description of steps taken to insure adequate reliability among instructor observers. This guide was published as a working document. There remains a requirement to use updated versions of PRSs for pilot training research studies. Therefore, to capitalize on the earlier experience of two professional research psychologists and eight flight instructors, it appears worthwhile to publish the data collection techniques used some 20 years ago and thereby document a departure point to which will reduce time and errors in upcoming programs. The following report (published unchanged) provides a description of all steps required to develop daily performance record sheets (PRS); provides examples of PRSs which were used successfully; describes instructor training necessary to insure satisfactory results; and highlights restrictions or limitation to the use of this technique. This report is provided as a reference document. (106 pp.)

199 **Valverde, H.H., Woods, W.J., & Kearns, N.H. Evaluation of a device to train forward air controllers to communicate target locations. AFHRL-TR-72-12, AD-751 292. Wright-Patterson AFB, OH: Advanced Systems Division, May 1972. Project 1710. NTIS.** This report describes the development and evaluation of a forward air controller (FAC) and tactical strike pilot (TAC) trainer. The trainer was designed to permit a FAC and a TAC to practice the tasks of communicating the location of targets. A previous analysis of communications between FAC and TAC personnel during actual combat had revealed that the task of verbalizing imagery (describing what one is seeing) was especially difficult and important to the success of the FAC/TAC mission. Subjects for the evaluation consisted of 35 Air Force pilots selected to be trained as forward air controllers at Hurlburt Field, Florida. The subjects were divided into 2 groups: Group A (N=18) received a one-hour pretest, two hours of supervised practice, and then a one-hour posttest. Group B (N=17) received only a one-hour pretest and a one-hour posttest. The achievement in gain of Group A was significantly greater than that of Group B. The results of a student questionnaire indicated that the FAC students enthusiastically endorsed the use of the trainer in teaching communication of target locations. The results of transfer of training were inconclusive. These results about transfer are not surprising because performance in the aircraft was evaluated using a subjective and rather gross scale. (55 pp.)

200 **Siegel, A.I., Bergman, B.A., Federman, P., & Sellman, W.S. Some techniques for the evaluation of technical training courses and students. AFHRL-TR-72-15, AD-753 094. Lowry AFB, CO: Technical Training Division, February 1972. Project 1121, Contract F41609-71-C-0025, Applied Psychological Services, Inc. NTIS.** This handbook attempts to present methods, concepts, and considerations to be held in mind in planning and implementing a student measurement or training evaluation program. Techniques are presented, procedures are discussed, and computational examples are included. The text places principal emphasis on basic techniques, but certain more advanced approaches are also considered. (137 pp.)

201 **Hoehn, A.J., Wilson, T.R., & Richards, J.A. Recruits' civilian-acquired skills: their potential value and their utilization in initial military assignments. AFHRL-TR-72-16, AD-748 326. Alexandria, VA: Manpower Development Division, February 1972. Project 4499, Contract F41609-70-C-0037. Human Resources Research Organization (HumRRO). NTIS.** The objective of the research reported here was to assess the potential value and the utilization of recruits' civilian-acquired skills. A recruit was defined as having a military-relevant civilian-acquired skill if he had had six months or more of

job experience in any of 67 common civilian jobs. The research data was obtained during March through June 1971 for four services: two Army sites, one each for Navy, Marine Corps, and Air Force. Data were collected by administering questionnaires to recruits; obtaining judgments of classification interviewers; and extracting information on initial military assignment, enlistment commitment, and AFQT scores from official records. Results indicate about 40% of the entering personnel surveyed met the civilian-acquired skill (CAS) criterion. Job skills varied, but tended to concentrate in a few civilian job categories. Results suggest that 20-30% of the incoming personnel with six or more months of military-relevant work experience received assignments likely to make significant use of such experience. (129 pp.)

202 **Hoehn, A.J., Wilson, T.R., & Richards, J.A. Recruits' military preferences and their accommodation by the military services. AFHRL-TR-72-19, AD-749 884. Alexandria, VA: Manpower Development Division, March 1972. Project 4499, Contract F41609-70-C-0037, Human Resources Research Organization (HumRRO). NTIS.** The principal objective was to provide information on recruits' military occupational preferences, match of military assignments to recruits' preferences, and changes that occur in these preferences between service entry and completion of basic training. Questionnaires were administered to recruits from four services just before classification interviewing and eight weeks later after initial military assignment. Small proportions of recruits' first choices were found to coincide with initial assignments of DOD occupational groups. However, over 60% received assignments to DOD occupational areas to which they gave relatively high interest ratings. Perhaps, for this reason, most men expressed satisfaction with their initial assignments. Recruits considered the services did relatively well in getting and using information on aptitudes and educational background, but not so well on getting and using information on preferences and preservice work. Recruits need improved knowledge of the military work areas. (125 pp.)

203 **Pieper, W.J., Catrow, E.J., Swezey, R.W., & Smith, E.A. Automated apprenticeship training (AAT): a systematized audio-visual approach to self-paced job training. AFHRL-TR-72-20, AD-764 818. Lowry AFB, CO: Technical Training Division, April 1973. Project 0079, Contract F33615-70-C-1286, Applied Science Associates, Inc. NTIS.** Two Automated Apprenticeship Training (AAT) courses were developed, administered, and evaluated for Air Force Security Police Law Enforcement and Security specialists. AAT is a systematized audio-visual approach to self-paced job training which employs an easily operated, portable and reliable teaching device. AAT courses were developed to be job specific and were based on a behavioral task analysis of the two Security Police specialty areas. AAT graduates were compared with graduates of comparable Airman Basic Resident (ABR) course and Career Development Course (CDC) for the same jobs in a Training Regime by Aptitude Group design. Evaluation criteria included a job specific performance test, and apprentice knowledge test and supervisor's ratings. Results indicated superior scores for the AAT graduates on the job performance test, and apprentice knowledge test and supervisor's ratings. Results indicated superior scores for the AAT graduates on the job performance test, and no differences among Training Regimes on the other criteria. A significant Aptitude effect was also obtained on the job performance test. The AAT Course was considered superior to other Training Regimes in terms of man-hours expended. Training supervisors also expressed a preference for the AAT technique. (226 pp.)

204 **Koplyay, J.B., Elton, J.H., & Gott, C.D. Mathematical considerations about the effects of guessing on test variance. AFHRL-TR-72-21, AD-749 883. Lackland AFB, TX: Personnel Research Division, March 1972. Project 6323. NTIS.** The relationship between true ability (operationally defined as the number of items for which the examinee actually knew the correct answer) and the effects of guessing upon observed test variance has been investigated. Three basic hypotheses were treated mathematically: (*a*) there is no functional relationship between true ability and guessing success: (*b*) there is a moderate functional relationship between true ability and guessing success; and

(*c*) there is a strong functional relationship between true ability and guessing success. Under the hypothesis of no functional relationship, true ability variance was found to be higher than the observed variance, suggesting that correction for guessing is advisable. Under the hypothesis of a moderate functional relationship, the observed and true test variances were about the same, imply no need for correction for guessing. Under the assumption of a strong functional relationship, observed test variance was much higher than the true variance (approximately twice as much), suggesting that approximately half of the observed test variance was due to guessing. This paper considered the appropriateness of correction for guessing dependent upon the assumed functional relationship between true ability and successful guessing. (8 pp.)

205 **Guinn, N., Alley, W.E., & Truax, S.R. Important factors in motivating AFROTC officer personnel in a zero-draft environment. AFHRL-TR-72-22, AD-754 965. Lackland AFB, TX: Personnel Research Division, March 1972. Project 7719. NTIS.** As the armed forces move toward a volunteer force, it becomes necessary to identify procurement and retention strategies which will be effective in maintaining viable force levels. A representative sample of AFROTC advanced cadets were surveyed to determine the effect of certain incentives on volunteerism, to identify AFROTC cadet attitudes toward a military assignment, and to evaluate the effect of certain aspects of military life on career decision. Results indicate that choice of career field and pay comparable to civilian earning capacity had the most influence in attracting volunteer officers, although negligible differences in officer quality were found between incentives. The most satisfying aspects of a military assignment included perceived job security and the type of work for an Air Force officer; the outstanding dissatisfier was perceived lack of personal control over career. Isolated tours and separation from family were perceived as the most negative aspects of an Air Force career. (13 pp.)

206 **Massey, I.H., Hoggatt, R.S., & Valentine, L.D., Jr. Aptitude levels in the enlisted manpower pool of the Air Force: 1971. AFHRL-TR-72-23, AD-749 494. Lackland AFB, TX: Personnel Research Division, March 1972. Project 7719. NTIS.** This report provides information concerning the aptitudes of active duty Air Force personnel as of 30 June 1971. Data are presented in a manner to allow for comparisons of Air Force enlisted personnel by length of service, career area, skill level, and military grade, or combinations of these factors. The data indicate that the Air Force continues to recruit and retain airmen capable of supporting the Air Force mission. The primary value of these data is for use in force planning. (40 pp.)

207 **Carpenter, J.B., & Christal, R.E. Predicting civilian position grades from occupational and background data. AFHRL-TR-72-24, AD-754 966. Lackland AFB, TX: Personnel Research Division, March 1972. Project 7734. NTIS.** A job analysis inventory was administered to civilian Air Force employees in the Accounting and Finance career field. Task performance data, provided by 5,485 job incumbents in seven General Schedule (GS) series, were analyzed using multiple regression techniques. The data were found to be highly predictive of the GS grade authorized for the position. Reported correlations are of a sufficient magnitude to suggest that knowledge of specific tasks performed can be used as a stable predictor of appropriate grade. Additionally, the data indicate that factors unrelated to job requirements, such as the incumbent's sex, age, or marital status, and unique job characteristics, such as geographical location and command to which assigned, do not act as a significant source of bias in grade determinations. In general, both the stability and the objectivity of existing civil service grade classifications are strongly supported. (14 pp.)

208 **Shenk, F. Predictability of expressed career intent. AFHRL-TR-72-25, AD-749 093. Lackland AFB, TX: Personnel Research Division, March 1972. Project 7719. NTIS.** An historical study of officer input from the various Air Force commissioning programs was initiated in 1963. The study was designed to determine the predictability of an Air Force officer's career decision and to evaluate relationships between career intent and demographic, environmental, and attitudinal factors. Career-intention information for this group has been compiled for the period prior to commissioning up to

five years of active duty. This report presents a description of the career-intent statement reliability and validity with career status as of December 1969. Subjects entering the Air Force through the Officer Training School–Airmen Education and Commissioning Program and Officer Candidate School had the highest percentage of officers remaining on active duty. Correlations between pre-commission career intent and the criterion were generally low; however, there was a consistent increase in predictability for data from succeeding years. (9 pp.)

209 **Cream, B.W. Evaluation of a trainer for sensor operators on gunship II aircraft. AFHRL-TR-72-27, AD-750 616. Wright-Patterson AFB, OH: Advanced Systems Division, September 1972. Project 1710. NTIS.** This report describes the design, development and evaluation of a training device intended to enable ground based practice of equipment operation and target tracking skills that are required by the Forward Looking Infrared (FLIR) and Low Light Level TV (LLLTV) sensor operators assigned to Gunship II aircraft. This trainer makes use of a relatively unique approach to tracking training by using video tape which is electronically manipulated so as to allow tracking in both simulated wide and narrow angle fields of views similar to actual equipment. (The complete description of the video equipment is provided in TR-72-41). In addition, the trainer incorporates both actual and mock-up instruments that enable the trainee to practice equipment operation procedures and malfunction isolation and correction. The evaluation of the training effectiveness of this device showed that sensor operators who received practice on this device reached the desired skill levels for both equipment pre-flight and target tracking sooner than those who had not received such training. As a result of the demonstrated value of this device, the using organization has incorporated it into their formal training curriculum. (40 pp.)

210 **Hoehn, A.J. Recruits' postservice occupational and educational plans: nature and the extent of influence from early military experience. AFHRL-TR-72-28, AD-750 145. Alexandria, VA: Manpower Development Division, April 1972. Project 4499, Contract F41609-70-C-0037, Human Resources Research Organization (HumRRO). NTIS.** Data on the nature of recruits' postservice occupational and educational plans, and on the influence that the first few weeks of military service have on such plans, were collected in March-June 1971 at Army, Navy, Marine Corps, and Air Force sites. One questionnaire was administered at the beginning, and one near the end of basic training. Results show that most recruits planned to be working fulltime one year after service, but were uncertain as to the type of work they would be doing. The data suggest that 30-40% of the men considered their initial assignment out of line with their job plans for one year after service. Results on occupational plans for age 35 closely paralleled those for one year after service, but the men seemed to be more definite about the kind of work they would be doing. About 40% said that they planned to be attending college one year after leaving service. Results generally showed early service experience to have little, if any, impact on postservice vocational and education plans. (61 pp.)

211 **Lecznar, W.B. The road to work: technical school training or directed duty assignment? AFHRL-TR-72-29, AD-754 845. Lackland AFB, TX: Personnel Research Division, April 1972. Project 7734. NTIS.** This study explored the question of differences between airmen who were assigned to jobs following graduation from formal resident training schools and those who entered a field as on-the-job trainees. Eight career fields which had substantial numbers of airman input as low ability personnel under Project 100,000 were studied. Evaluations of technical school graduates and directed duty assignees were made in terms of six criteria: a job difficulty index, average task difficulty, number of tasks performed, job interest, self-report of utilization of talent and training, and overall performance ratings. Using the multiple linear regression model, with time in service as a concomitant variable interacting with the training type membership categories (*i.e.*, resident technical course or direct assignment) and with aptitude held constant, tests of the significance in difference between regression lines were made. In nearly every instance, the results indicated that the intercepts and slopes of the lines for the two groups were the same. That is, technical school graduates and

directed duty assignees were not different on any of the six criterion comparisons. This is not to suggest, however, that formal school training can be wholly displaced by on-the-job training. (24 pp.)

212 **Brown, J.S., Burton, R.R., & Zdybel, F. A model driven question-answering system for a CAI environment. AFHRL-TR-72-39, AD-760 115. Lowry AFB, CO: Technical Training Division, March 1973. Project 7907, Contract F33615-70-C-1726, System Development Corp. NTIS.** This report describes a question-answering system which permits students in a computer assisted instruction (CAI) environment greater initiative in the variety of questions they can ask concerning the subject area being studied. A method of representing processes as augmented finite-state automata is developed and is shown not only to permit efficient inferencing about dynamic processes but also to provide a satisfactory deep structure for paragraph generation. A CAI system dealing with meteorology is described which uses this automaton model to represent the processes in meteorology. Coupled with the dynamic process model is a semantic conceptual network which contains the static information about meteorology. Examples of the inferencing techniques using both the automaton model and the semantic network are given. A sample session with this system is included in the Appendices. (54 pp.)

213 **Fugill, J.W.K. Task difficulty and task aptitude benchmark scales for the mechanical and electronics career fields. AFHRL-TR-72-40, AD-754 848. Lackland AFB, TX: Personnel Research Division, April 1972. Project 7734. NTIS.** This exploratory study examined the feasibility of constructing benchmark scales on the dimensions of task difficulty and task aptitude for tasks in mechanical and electronics job areas. It was determined that small numbers of work supervisors and behavioral scientists can achieve high interrater agreement on the dimensions of task difficulty and task aptitude, respectively. The rank-difference correlation coefficients between the task difficulty and task aptitude scales was 0.89 for the mechanical task statements and 0.92 for the electronics task statements. Assuming consistently high correlations between work supervisors' judgments of difficulty and behavioral scientists' judgments of aptitude, task aptitude requirements may be inferred directly from task difficulty values as designated by work supervisors in the field. (34 pp.)

214 **Hoehn, A.J. Postservice occupational and educational plans of first-tour military personnel nearing separation from the service. AFHRL-TR-72-42, AD-751 488. Alexandria, VA: Manpower Development Division, May 1972. Project 4499, Contract F41609-70-C-0037, Human Resources Research Organization (HumRRO), NTIS.** A study was made of several aspects of the postservice educational and occupational plans of first-tour enlisted personnel nearing separation from military service. Data were collected using a questionnaire administered at military sites during September-December, 1971. Usable returns were obtained from 3946 men from four services: Air Force, 481; Army, 942; Marine Corps, 783; and Navy 1740. Analyses were made to characterize the postservice plans of the respondents and to identify correlates of these plans. A large majority of the men said they wanted to enter full-time employment soon after leaving the service. Almost half indicated they already had a part- or full-time job promised. Most men expected to be in full-time work one year postservice, but four out of ten were not very definite about the type of work they would be in. Although most men expect to pursue full-time work, results show a widespread interest in further training or education. The most prominent predictor of school versus work orientation for post-service plans is current educational level, although the relationship is not linear. Only about one of four men expected to use his military job training experience either in a civilian job or in related education or training. Results are interpreted by the writer as implying the need for continued, or even improved, pre-separation counseling to assist men in formulating their postservice plans, in locating jobs, and in becoming more aware of the potential value of the job skills they have acquired while in military service. (156 pp.)

215 **Valverde, H.H., Lebkisher, H.E., & Reynolds, A. Annotated bibliography of the Advanced Systems Division reports (1950–1972). AFHRL-TR-72-43, AD-760 114. Wright-Patterson AFB, OH:**

Advanced Systems Division, March 1973. Project 1710. NTIS. The Advanced Systems Division of the Air Force Human Resources Laboratory, Air Force Systems Command conducts research and development in the areas of training techniques, psychological and engineering aspects of training equipment, and personnel and training factors in the design of new systems and equipment. This unclassified, unlimited annotated bibliography lists the memorandum reports, technical reports and journal articles prepared by the Advanced Systems Division from 1950 until the end of 1972. The citations are arranged chronologically by year and alphabetically by author within each year. Three indexes are included: (1) the Author, Category, and Abstract Number Index, (2) Subject Index, and (3) the Memorandum Reports, Technical Notes, and Technical Reports Index. (248 pp.)

216 **Slebodnick, E.B., Anderson, C.D., Fagan, P., & Lisez, L. Development of alternative continuing educational systems for preventing the technological obsolescence of Air Force scientists and engineers: basic study. AFHRL-TR-72-46(I), AD-751 489. Brooks AFB, TX: Professional Education Division, May 1972. Project 1125, Contract F41609-71-C-0012, The Boeing Company. NTIS.** Volume I of this study reports a work effort to define and give guidelines for the acquisition of cost-effective alternative continuing education (C.E.) systems to prevent the technological obsolescence of Air Force military scientific and engineering officer personnel. A detailed background survey of the problem was conducted using questionnaires, personal interviews, and literature searches. Various requirements for the updating of technological knowledge and skills were defined. Current C.E. programs within universities, industry, and government agencies, both civilian and military, are reviewed and compared. Literature on the characteristics, causes, and results of technological obsolescence are reviewed and guidelines for the development of an obsolescence scale are presented. An evaluation of candidate methods of C.E. is presented. An "ideal future system" of individualized automated C.E., using student-computer interactive consoles, is developed. Three alternative systems, presently deployable, are developed and described. Motivational subsystems to promote the effectiveness of both the alternative systems and the current Air Force C.E. system are developed. The data and specifications for the acquisition and test of each of the alternative systems are presented. A three-phase comparative evaluation technique for the selection of the most cost-effective system to be deployed under a given set of conditions is developed. It is recommended that the Air Force set as a goal the development of the "ideal future system," and that all alternative C.E. systems developed be applied to meet present conditions and to serve as test and development instruments in the achievement of this goal. (298 pp.)

217 **Lisez, L., & Slebodnick, E.B. Development of alternative continuing educational systems for preventing the technological obsolescence of Air Force scientists and engineers: survey of continuing educational programs within selected industries and universities. AFHRL-TR-72-46(II), AD-751 490. Brooks AFB, TX: Professional Education Division, June 1972. Project 1125, Contract F41609-71-C-0012, The Boeing Company. NTIS.** Survey data obtained in this study complements information previously obtained under Air Force contract F41609-71-C-0012 for the prevention of technological obsolescence among Air Force scientists and engineers. The data were gathered through the use of questionnaires designed especially for use in selected industries and universities where previous literature searches revealed new and innovative approaches for the prevention and remediation of technological obsolescence were most likely in development or use.

Survey data obtained from industries and universities are summarized and analyzed from the standpoint of the Air Force's requirement for updating its military scientists and engineers. It is concluded that the wide range of innovative methods of C.E. in use or in development within selected industries and universities, can be of use to the Air Force in developing alternative systems or enhancing its current system of continuing education (C.E.). Also, the initiative being taken by colleges and universities to meet the mounting updating needs of engineers and scientists, management personnel, and health professionals, particularly physicians, was a revealing finding. The greatest effort and the most experimentation, however, is occurring in the field of postgraduate medical education. The Air Force's effort in implementing alternative systems of C.E. could be greatly

accelerated if it adopted many of the innovative motivational techniques and methods of C.E. that both physicians and other health personnel have available to assist them in meeting their renewal and continuing education needs. (70 pp.)

218 **Miller, R.E. Development and standardization of the Air Force Officer Qualifying Test Form L. AFHRL-TR-72-47, AD-754 849. Lackland AFB, TX: Personnel Research Division, May 1972. Project 7719. NTIS.** In accordance with the normal replacement cycle, a new form of the Air Force Officer Qualifying Test (AFOQT) was developed for implementation in Fiscal Year 1972. The new form is designated Form L. It resembles other recent forms in type of content, organization, and norming strategy. Like other forms, it yields Pilot, Navigator-Technical, Officer Quality, Verbal, and Quantitative composite scores for operational use. Standardization involved the use of the Project TALENT battery in a way which permits relating AFOQT scores to Air Force Academy candidates and to 12th grade males in the Project TALENT national survey. Form L differs from earlier forms by the introduction of Digitek answer sheets and by a slight shortening which does not reduce the total amount of elicited scorable behavior. Although new forms of the AFOQT can not be validated immediately, new validation data from older forms are assumed to characterize new forms also. Some new validation data for flying training criteria are presented. (7 pp.)

219 **Sullivan, D.J., & Smith, E.A. Instructional media and carrel systems. AFHRL-TR-72-48, AD-778 068. Lowry AFB, CO: Technical Training Division, February 1974. Project 1193, Contract F33615-71-C-1860, Hughes Aircraft Company. NTIS.** Implementation of a major computer-managed individualized instructional system (Advanced Instructional System) requires considerable attention to both instructional environments and the media hardware and software employed. This report examines the instructional milieu with respect to performance analyses, learning carrel requirements and the equipment and techniques required to develop and maintain the software (audio-visual materials) for a large scale individualized instructional program. (210 pp.)

220 **Vitola, B.M., & Brokaw, L.D. Comparison of 1970 and 1971 Air Force enlistees by draft-vulnerability category. AFHRL-TR-72-49, AD-760 537. Lackland AFB, TX: Personnel Research Division, March 1973. Project 7719. NTIS.** On the basis of draft vulnerability, the 1970 and 1971 accessions were categorized into four groups defined in terms of age and draft pressure. These groups designated as high, moderate, low draft-pressure and draft non-eligible, were compared on various dimensions. Compared to the 1970 accessions, the 1971 accessions demonstrated less aptitude and were less well-educated. There was an appreciable rise in the number of accessions having 11 years or less of education, especially in the low draft-pressure and draft non-eligible groups. The data suggest that, under present incentive enlistment programs, zero-draft manpower resources at the higher aptitude levels may be more limited. (8 pp.)

221 **Hansen, D.N., Brown, B.R., Merrill, P.F., Tennyson, R., Thomas, D.B., & Kribs, H.D. The analysis and development of an adaptive instructional model(s) for individualized technical training: phase I. AFHRL-TR-72-50(I), AD-781 042. Lowry AFB, CO: Technical Training Division, August 1973. Project 1193, Contract F33615-72-C-1277, Florida State University. NTIS.** Shrinking training budgets pose a serious problem to those confronted with the present and future challenge of providing competent Air Force technicians for increasingly technical positions in a modern Air Force. One promising solution to this problem has been to harness the capabilities of the computer as an instructional training device. To be cost-effective, computer-based instruction must maximize individual student attainment of training objectives, while simultaneously minimizing training time and costs. Adaptive Instructional Models (AIM) constitute the means by which effective training can be accomplished with a minimum expenditure of student time and instructional resources. The report describes the purpose and function of AIM. Additionally, seven adaptive instructional models, to include supporting literature, have been analyzed and recommendations as to model application in Air Force technical training courses have been made. (116 pp.)

222 **Hansen, D.N., Tennyson, R., Kribs, H.D., Taylor, S., James, T., & Tam, P. A guide to computer simulations of three adaptive instructional models for the advanced instructional system: phase II and III. AFHRL-TR-72-50(II), AD-775 713. Lowry AFB, CO: Technical Training Division, October 1973. Project 1193, Contract F33615-72-C-1277, Florida State University. NTIS.** This report concludes Phases II and III of Air Force research on the application of Adaptive Instructional Models (AIM) to Individualized Technical Training. Phase I research concluded with a recommendation to employ five state-of-the-art AIMs in the Air Force Human Resources Laboratory's Advanced Instructional System (AIS). Adaptive models recommended for AIS field implementation included (1) Drill and Practice, (2) Concept Acquisition, (3) Complex Tutorial, (4) Algorithmic Regression, and (5) Dynamic Programming. Two additional models were analyzed and recommended for further research prior to field implementation within the AIS. These models were (1) Natural Language Processing and (2) Automaton Models. Findings related to the simulation of three adaptive models and a user's guide for the models simulated are provided in the present report. Additionally, the report includes applied recommendations and methods for model validation. (45 pp.)

223 **Christal, R.E. CODAP: input standard (INPSTD) and variable generation (VARGEN) programs. AFHRL-TR-72-51, AD-750 144. Lackland AFB, TX: Personnel Research Division, May 1972. Project 7734. NTIS.** This is one in a series of reports written to acquaint occupational analysts, occupational research personnel, and personnel managers with the functions and utilities of CODAP, a *C*omprehensive set of *O*ccupational *D*ata *A*nalysis *P*rograms. This particular report describes and gives example applications for the Input Standard program (INPSTD) and the Variable Generation program (VARGEN). (8 pp.)

224 **Shore, C.W., & Marion, R. Suitability of using common selection test standards for Negro and white airmen. AFHRL-TR-72-53, AD-775 846. Lackland AFB, TX: Personnel Research Division, May 1972. Project 7719. NTIS.** The effectiveness and equity of applying uniform selection standards to both Negro and white Air Force enlistees was investigated by regression analyses. For both racial groups, the relationship between the Air Force selection test (Airman Qualifying Examination) as the predictor and a measure of job knowledge (Specialty Knowledge Test) as the criterion was compared for Negro and white airmen belonging to one of 16 promotion groups. In no groups were Negro criterion scores underpredicted by the selection tests. In nine groups there were racial differences in the regression lines, and in all instances of differences the Negro criterion scores were overpredicted by the common regression lines. (10 pp.)

225 **Gum, D.R. Modeling of the human force and motion-sensing mechanisms. AFHRL-TR-72-54, AD-766 444. Wright-Patterson AFB, OH: Advanced Systems Division, June 1973. Project 6114. NTIS.** The purpose of the study was: to investigate human force and motion-sensing mechanisms; to develop models for the prominent or potentially artificially stimulatable mechanisms; to implement them on an analog computer; and to investigate their responses to various force and motion-forcing functions. Models were implemented and tested for a semicircular canal, the otolith, head motion muscle spindle sensing, and body seat pressure sensing. The relative magnitude of the sensed force and motion through the various mechanisms has not been possible to assess because the action of some mechanism transducers, i.e., the Pacinian receptors, and the processing of the information received from the various receptors is not well understood. However, tests of the models have demonstrated the relative time delays between applied force and perceived force for the various mechanisms, showing that both the muscle spindle and pressure-sensing mechanisms perceive an applied force much more rapidly than the vestibular system. Also, the long adaptation phenomenon associated with the semicircular canals which seems to degrade their usefulness in flight and the rapid adaptation phenomenon associated with the pressure sensors which makes them important sensors for consideration in the design of motion systems have been shown through model testing. (86 pp.)

226 **Fitzgerald, J.A., & Moulton, D.L. Evaluation of airborne audio-video recording as a tool for training in the A-70 tactical fighter. AFHRL-TR-72-55, AD-744 041. Williams AFB, AZ: Flying Training Division, October 1971. Project 1123. NTIS.** This report documents the results of a study to evaluate an airborne audio video recording system in a Head-Up Display (HUD) equipped fighter aircraft, the A-7D, as a method of improving the quality of training. The results, although lacking quantitative rigor, indicate that the use of audio video recording equipment can be of real value in the training of fighter pilots. It is recommended that such capability be a basic design consideration in all new fighter aircraft. (6 pp.)

227 **Dunham, A.D. Estimated cost of on-the-job training to the 3-skill level in the communications center operations specialty. AFHRL-TR-72-56, AD-753 093. Lackland AFB, TX: Personnel Research Division, June 1972. Project 2077. NTIS.** Decisions concerned with the use of alternative Air Force training methods require several types of data. Among these are capacity to train, cost of the training, and quality of the trained airmen. The two methods of formal training in the Air Force are on-the-job training (OJT) and technical school training. The data currently being provided to decision makers for selecting the proper mix of these two training methods can be substantially improved. (26 pp.)

228 **Luckew, R.S. The use of simulation models for decisions pertaining to the "best" mix of aircraft, support personnel, spare parts, and level of repair. AFHRL-TR-72-57, AD-764 735. Wright-Patterson AFB, OH: Advanced Systems Division, March 1973. Project 1124. NTIS.** Recently Tactical Air Command changed their maintenance plan so that now the entire Air Force is on a 66-1 maintenance concept. Flight line maintenance personnel will be available to do shop work under this concept. The Air Force is also changing their method for determining spare levels with the advent of the Advanced Logistics System. These two changes will have an impact on many of the decisions made during the development of a weapon system. One of the largest impacts will be in the logistics area, especially level of repair analysis. This report describes the current state of the technology available for decisions which determine the level of repair or discard (LOR) policies. A methodology based on the research which defined the state of LOR technology is recommended which considers both the availability of flight line personnel to do shop work and the new spare level policy of the Air Force. (14 pp.)

229 **Usdin, E., & Shenk, F. Validity of background and interest tests for officer stated career intent. AFHRL-TR-72-58, AD-758 818. Lackland AFB, TX: Personnel Research Division, February 1973. Project 7719, Contract F41609-71-C-0036, Southwestern Computing Service, Inc. NTIS.** Prior studies have indicated the possible utility of the Strong Vocational Interest Blank and the Importance-Possibility Scale for the purpose of measuring career motivation in junior officers. In this study, the existing keys for these instruments were evaluated and some new keys developed. For a criterion of expressed career intent, the new keys were found to have validities considerably higher than those previously available. Moreover, the revised and expanded version of the Importance-Possibility Scale appears to be a better predictor of career intent than the Strong Vocational Interest Blank. (7 pp.)

230 **Wiley, L.N. Analysis of the difficulty of jobs performed by first-term airmen in 11 career ladders. AFHRL-TR-72-60, AD-757 876. Lackland AFB, TX: Personnel Research Division, July 1972. Project 7734. NTIS.** For specialties to which low-aptitude airmen are assigned what relationship can be found between airman aptitude and the difficulty of assigned jobs? Job difficulty was measured from inventories, and its variance was predicted by regression, using 40 predictors involving service time, aptitude, place, enlistment age, and technical school graduation. There were 13,921 inventories, embracing 11 ladders. A maximum of 22.3 percent of job difficulty variance was accountable. Time, consisting of one or more aspects of time on the job, time in the career ladder, or total active service, was the best predictor. Place, which included command, base size, and geographical location, was second best. As a predictor, aptitude was a poor third, accounting for 2.3 percent maximum. The relationship between aptitude and job difficulty was nonsignificant over half the time and always small. (22 pp.)

231 **Woodruff, R.R., & Hagin, W.V. Dynamic observation in T-37 undergraduate pilot training (UPT) link trainers (T-4). AFHRL-TR-72-61, AD-759 171. Williams AFB, AZ: Flying Training Division, February 1973. Project 1123. NTIS.** Dynamic observation in undergraduate pilot training (UPT) was evaluated in an exploratory study. A primary purpose of the study was to gain research experience in an Air Training Command operational situation, but nevertheless, interesting results were obtained. The study compared the performance of three undergraduate pilot training student groups using T-4 instrument trainers. One group were dynamic observers; they observed each trainer sortie before "flying" it while they were observed. Members of a second group flew while observed but were not dynamic observers themselves. A third control group received trainer instruction as usual. Results indicate significant value in being observed as opposed to observing in all tasks studied. Results also indicate that dynamic observation has value in procedural tasks. Areas for further investigation are identified. (6 pp.)

232 **Baum, D.R., Smith, J.F., & Goebel, R.A. Selection and analysis of UPT maneuvers for automated proficiency measurement development. AFHRL-TR-72-62, AD-767 580. Williams AFB, AZ: Flying Training Division, July 1973. Project 1123. NTIS.** A program exists within the Air Force Human Resources Laboratory to develop techniques for automated assessment of pilot performance. To insure that quantitative assessment capabilities are available for the evaluation of Advanced Simulator for Undergraduate Pilot Training (ASUPT) and to make efficient use of existing resources, measurement development is being limited initially to six aircraft maneuvers. These are (*a*) Lazy 8, (*b*) Barrel Roll, (*c*) Normal Pattern and Landing, (*d*) Cloverleaf, (*e*) Normal Spin, and (*f*) Split-S. The rationale for selection of these particular maneuvers is discussed in the first part of this report. Subsequent to selection, extensive maneuver analyses were performed. The analysis format was chosen specifically for the purpose of supporting automated proficiency measurement development. The categories of information which constitute the analyses are described and the procedures whereby the information was obtained are detailed. (56 pp.)

233 **Taylor, C.L. Response factors and selective attention in learning from instructional materials: an annotated bibliography. AFHRL-TR-72-63, AD-754 850. Williams AFB, AZ: Flying Training Division, April 1972. Project 1123, Contract F41609-71-C-0027, Arizona State University. NTIS.** The studies and research reviews included in this bibliography consist primarily of published works dealing with the effects on learning from instructional materials of (1) overt and covert responding, and (2) such attention-directing devices as the presentation of instructional objectives and test-embedded questions.

Sources used to identify appropriate documents to be abstracted for inclusion in the annotated bibliography include ERIC, Education Index, and Psychological Abstracts. The annotated bibliography presented herein consists of 103 edited abstracts. (31 pp.)

234 **Eckstrand, G.A. Human resources considerations in the development of complex systems. AFHRL-TR-72-64, AD-756 837. Wright-Patterson AFB, OH: Advanced Systems Division, September 1972. Project 1124. NTIS.** This paper presents and elaborates the following general thesis: military psychologists will never be more than marginally effective in providing solutions to problems in the areas of personnel, training, operational performance and even job satisfaction unless and until they develop the power, the talent and the technology to have a significant influence on the design of complex military systems and equipment. In today's highly technological military services, the most powerful variable determining what people do, the skills they require, and the environments in which they work is the nature of the weapon systems and support equipment acquired by the services. It is here, then, in this area, that the problems of military psychology must be first addressed. The paper discusses the technology of human resources engineering which refers to the design of a hardware system with regard to its total human resources impact over the life of the system. Five research efforts which are relevant to a technology of human resources engineering are described: (1) the

impact of human resources data on system design, (2) the use of human resources data in system design trade studies, (3) use of a simulation model to forecast and control manpower requirements for new systems, (4) relationship between subsystem design, maintenance skill requirements and job performance, and (5) development of a human resources data handbook for systems engineering. The paper concludes with a discussion of some of the broad issues involved in designing organizations and systems against criteria which include the fulfillment and growth of the individuals who will be involved. (36 pp.)

235 **Pieper, W.J., & Smith, E.A. Development of a video system for rapid generation of learning sequences. AFHRL-TR-72-65, AD-756 522. Lowry AFB, CO: Technical Training Division, July 1972. Project 1121, Contract F41609-71-C-0020, Applied Science Associates, Inc. NTIS.** The objective of this program was to develop and evaluate an improved portable video system for use as an instructional software design tool. The initial system was designed for use by personnel engaged in research and development in training techniques. It greatly increased the effectiveness and reduced the cost of producing experimental audio-visual materials (e.g., slides, movies, etc.) by providing increased flexibility in scripting, editing, and content review prior to hard copy and permanent recording. (58 pp.)

236 **Garza, A.T. Occupational survey of seven accounting and finance civil service series. AFHRL-TR-72-67, AD-754 967. Lackland AFB, TX: Personnel Research Division, July 1972. Project 7734. NTIS.** The initial effort in applying job analysis methodology to Air Force civil service jobs involved the following Accounting and Finance series: GS-501, GS-520, GS-525, GS-530, GS-540, GS-544, and GS-545. The survey instrument, a job inventory, was administered Air Force wide. From a total population of 6,460, the return of usable inventories equaled 5,555, or 86 percent of the total.

The job inventory covered the seven Accounting and Finance series with 683 tasks grouped under 14 duties. Job incumbents in grade levels GS-1 through GS-11 completed a background information section and provided estimations of the relative time spent on the tasks performed using a 7-point scale. Job descriptions from the seven series grouped into 10 clusters comprised of 141 job types. Three separate job types were also identified. The complete report provides comprehensive descriptive information on all job types and clusters.

A comparison of the seven series, in terms of time incumbents spend on tasks, revealed a significant overlap of 74 percent between the Accounts Maintenance Clerical Series GS-520 and the Accounting Technician Series GS-525. The next highest overlap, 57.1 percent, is between the General Accounting Clerical and Administrative Series GS-501 and the Accounts Maintenance Clerical Series GS-520. The third highest overlap, 53.9 percent, is between the General Accounting Clerical and Administrative Series GS-501 and the Accounting Technician Series GS-525. The notable similarity in work function between GS-520 and GS-525 suggests that consideration be given to consolidating the two series.

In regard to job-type analysis, two characteristics of job incumbents show substantial variance in a large number of job types and therefore merit further inquiry: series classification and grade level allocation. The data suggest that the series could be structured according to subject matter area to coincide with the nine subject matter job type clusters obtained in this analysis. The job types within the tenth cluster, General Accounting and Finance Supervisor, belong within the nine subject matter clusters.

The applicability of the Air Force job analysis methodology to civilian positions appears fruitful. Since this methodology was developed with military jobs, some adaptations are to be expected in accommodating personnel management policies peculiar to civilian jobs. However, the current methodology serves the primary function of describing civilian jobs with an apparent efficacy equal to that of military jobs. (6 pp.)

237 **Hatch, R.S., Pierce, M., Nauta, F., & Zimmer, C.E. Airman training line simulator. AFHRL-TR-72-69, AD-754 851. Lackland AFB, TX: Personnel Research Division, August 1972. Project 6323, Contract F41609-70-C-0047, Decision Systems Associates, Inc. NTIS.** The Airman Training Line Simulator was designed as a managerial aid for investigating and evaluating the various and diverse policy interactions which impact on Basic Military Training and entry-level Technical Training courses. This user's manual provides user-oriented documentation in sufficient detail to give the prospective user a complete grasp of the concepts and logic underlying the model. The presentation includes: (a) a comprehensive overview of the system; (b) a description of the Simulator's modules and the interrelationships of their inputs and outputs; (c) detailed instructions on input card formats, with appropriate discussion as to the relationship between input parameters and applications of the model; and (d) a description and explanation of reports generated by the Simulator and the relationship between individual input data items and output report items. (91 pp.)

238 **Lintz, L.M., Loy, S.L., Hopper, R., & Potempa, K.W. Relationship between design characteristics of avionics subsystems and training cost, training difficulty, and job performance. AFHRL-TR-72-70, AD-759 583. Wright-Patterson AFB, OH: Advanced Systems Division, September 1972. Project 1124, Contract F33615-71-C-1620, McDonnell Douglas Astronautics Company – East. NTIS.** The relationships between subsystem design characteristics, training cost, training difficulty, and job performance were investigated for avionics subsystems. A list of relevant design characteristics was established, based on expert opinions of avionics engineers, Air Force (AF) training supervisors, and AF instructors. Functional loops were selected from 10 subsystems representing navigation, flight control, communications, and fire control subsystems. Performance examinations for each of the 30 functional loops were identified or constructed. Ten AF students performed each of the examinations. Time and errors were recorded for using equipment and reading technical orders (T.O.). Both stepwise regressions and factor analysis were used to derive equations to predict performance time, training time, T.O. time, errors, and training equipment cost from equipment design characteristics, personnel characteristics, and environmental variables. Multiple correlation coefficients were 0.88 and greater. Factors of Length of Checkout Procedure, Equipment Complexity, Difficulty of Checkout Steps, Nonautomatic Checkout, Diagnostic Information, and Clarity of Information were identified. Additional research is recommended. (53 pp.)

239 **Baer, L.H. Learning center evaluation measurement of students' attitudes toward undergraduate pilot training learning centers. AFHRL-TR-72-71(I), AD-760 538. Williams AFB, AZ: Flying Training Division, March 1973. Project 1123. NTIS.** This project was an initial study to ascertain the impact, effectiveness, and acceptance of learning centers within Undergraduate Pilot Training (UPT). Using an in-house developed scale, characterized by equal-appearing intervals as first proposed by Thurstone and Chave, measurement of student attitude toward UPT learning centers was made. Administration of the scale to 297 UPT students produced very strong evidence of positive, favorable attitude toward the learning center concept. Comments, obtained during student interviews and final form administration, may be beneficial to learning center managers and operators. (16 pp.)

240 **Baer, L.H., & Beggerly, J.D. Learning center evaluation: teaching an undergraduate pilot training academic course in the learning center. AFHRL-TR-72-71(II), AD-760 539. Williams AFB, AZ: Flying Training Division, March 1973. Project 1123. NTIS.** This project describes the modification of an Undergraduate Pilot Training (UPT) academic course for presentation in the UPT learning center. Course objectives, final examination and workbook exercises were unchanged. The lecture portions of the flight instruments course were prepared for sound-slide presentation in the learning center, and the effectiveness and time saved by this approach were evaluated. It was concluded that the learning center is a very suitable environment for presenting an academic course and that the time saved, without affecting achievement, warrants expansion of this effort to include other UPT academic courses. (3 pp.)

241 **Foley, J.P., Jr. Description and results of the Air Force research and development program for the improvement of maintenance efficiency. AFHRL-TR-72-72, AD-771 000. Wright-Patterson AFB, OH: Advanced Systems Division, November 1973. Project 1710. NTIS.** This paper is one of three prepared for a 1972 APA Symposium entitled "The Impact of Behavioral Science on the Maintenance of Machine Subsystems." This paper and its accompanying slides give an overview of the Air Force Research and Development Program for the improvement of maintenance efficiency. Some references to related work of other DOD agencies and civilian concerns are also made. It emphasizes the use of the task analysis process in all of these efforts. Although the central theme emphasizes the job performance aids efforts, attention is also given to job oriented training and job task performance tests. The results of two experiments are briefly summarized: (1) an experiment of the Air Force Human Resources Laboratory in which high and medium aptitude subjects with only 12 hours of training successfully accomplished checkout procedures, troubleshooting and remove and replace actions on an electronic equipment using job performance aids and (2) a SAMSO (Space and Missile Systems Organization) experiment entitled PIMO (Presentation of Information for Maintenance and Operation) in which experienced technicians, apprentice technicians, and personnel from unrelated career fields accomplished error free maintenance on all types of flight line maintenance tasks except troubleshooting on the C-141 aircraft. In addition, a 1972 demonstration combining job performance aids with job oriented training is described. In this demonstration, successful flight line and field shop maintenance of a doppler radar and its computer were performed by airmen of both high and average electronic aptitude after only four weeks of job oriented training if they used job performance aids. (43 pp.)

242 **Foley, J.P., Jr. Task analysis for job performance aids and related training. AFHRL-TR-72-73, AD-771 001. Wright-Patterson AFB, OH: Advanced Systems Division, November 1973. Project 1710. NTIS.** This paper presents several aspects of task analyses for maintenance jobs when these analyses are used as bases for the development of job performance aids (JPAs) and job oriented training. It starts with a brief history of the development of task analysis technology and the part that Air Force research has played in this development. A formal structure is required when such task analyses have many uses. The fact that task identification is but the first step in any task analysis is emphasized. After tasks are identified, the type of analysis depends on the purpose for which the analysis is being made. Job observation, questionnaire, interview, and hardware analysis are some means that are available for identification of job tasks. Task identification, based primarily on hardware analysis, is the most appropriate basis for maintenance jobs. A scheme or format to accomplish this, called a Task Identification Matrix, is presented and described. A structured scheme for analyzing the identified tasks for JPA development is also presented and includes documents such as the *Task Description Index and Management Matrix, Task Step Data Detail Test Equipment and Tool Use Form.* For maximum effectiveness and efficiency, JPAs and training should be developed to effect optimum trade off between training and JPAs. The analytic questions concerning training which must be answered by a task analysis for JPA developers and training specialist are introduced and plans for a scheme for accomplishment are mentioned. (41 pp.)

243 **Pieper, W.J., Foss, F.C., & Smith, E.A. Instructional strategies for a performance oriented technician course. AFHRL-TR-72-74, AD-760 116. Lowry AFB, CO: Technical Training Division, March 1973. Project 1193, Contract F33615-71-C-1908, Applied Science Associates, Inc. NTIS.** A study was initiated to devise innovative instructional strategies to be used in a performance oriented technical training course. The strategies devised were student centered and applicable for self-pacing in a proposed computer based Advanced Instructional System (AIS). A detailed examination was made of the current course, concentrating on course content, instructional strategies, student characteristics, instructor characteristics, and course administration. Strategies were then generated based on data gathered during the course analysis. Of the 56 strategies generated, 5 were chosen for detailed development and demonstration of their feasibility in the current Weapons Mechanic (TAC) Course. An evaluation of selected strategies will be performed in the near future. (161 pp.)

244 **Lintz, L.M., Loy, S.L., Brock, G.R., & Potempa, K.W. Predicting maintenance task difficulty and personnel skill requirements based on design parameters of avionics subsystems. AFHRL-TR-72-75, AD-768 415. Wright-Patterson AFB, OH: Advanced Systems Division, August 1973. Project 1124, Contract F33615-71-C-1620, McDonnell Douglas Astronautics Company – East. NTIS.** The relationships among subsystem design characteristics, personnel skill characteristics, and job performance were investigated for avionics subsystems. A list of design characteristics was established, based on expert opinions of avionics engineers, Air Force supervisors, and instructors. Functional loops and line replaceable units were selected from ten subsystems representing navigation, flight control, communications, and fire control subsystems. Experienced maintenance supervisors identified high skill and low skill maintenance personnel. The same supervisors associated performance times and error probabilities with these personnel for three maintenance tasks – an easy task, a difficult task, and a complete functional checkout task. Supervisors also rated each task on a scale of difficulty. Both stepwise regressions and factor analysis were used to derive equations for predicting performance time, error probability, and task difficulty from design characteristics. Similar analyses derived equations relating performance time and errors to personnel characteristics. Multiple correlation coefficients were from 0.50 to 0.93. Personnel factors of Experience, Aptitude, Breadth of Skills, Motivation, Training, Time in Grade, and Non-AF Technical Education were identified. Equipment design factors of Checkout Complexity, Checkout Information, Length of Checkout, Accessibility, Equipment Complexity, and Test Equipment and Adjustments are associated with performance times and errors. (133 pp.)

245 **Shenk, F. Development and validation of scores to predict officer career status. AFHRL-TR-73-1, AD-760 540. Lackland AFB, TX: Personnel Research Division, March 1973. Project 7719. NTIS.** During 1963 a long-term study of officer input, from the principal Air Force commissioning sources, was initiated. This study was designed to determine the predictability of an officer's career decision and to evaluate relationships between career intent, various demographic, environmental and attitudinal factors, and career status. This report presents the development and validation of various scores designed to predict career status.

Survey data were collected from individuals before they entered active duty, and annually, through five years of active military service. The scores designed to predict career status were determined from each individual's yearly survey responses. Generally, the relationship between career status and the scores based on responses prior to commissioning were quite low; however, there was a definite increase in prediction after the subjects experienced active duty. The largest increase in predictability occurred during the first two years of active duty. This seems to indicate a plateau in the subject's attitude toward the military career. Offer of Air Force opportunities such as education, training, and Regular commissions might be more effective at this point, than at the time of commissioning. In addition, from an economical standpoint, the Air Force might realize considerable savings in training costs by sending those junior officers most likely to remain on active duty to the more expensive educational and training programs. The Career Intent Score was the measurement device most predictive of future career status although correlations were only moderate. (23 pp.)

246 **Vertreace, W.C., & Knouse, S.B. Attitudes of airmen toward the weighted airman promotion system. AFHRL-TR-73-2, AD-767 577. Lackland AFB, TX: Personnel Research Division, April 1973. Project 7719. NTIS.** The Weighted Airman Promotion System (WAPS) was designed to select airmen for promotion on the basis of six weighted factors. It was instituted as a means for increasing knowledge of standing in promotion competition and insuring equitable promotion opportunities. The present survey was initiated to assess the attitudes of airmen affected by WAPS and determine if airmen perceive WAPS as having fulfilled its objectives.

The more favorable attitudes towards the WAPS system were held by airmen who had been promoted under the system, although both promoted and nonpromoted personnel feel that WAPS is fairer than the whole-man system with promotion boards. Although a substantial number of the first

term enlistees felt that they did not know enough about the old system to make a comparison, the general consensus was that WAPS is fairer than the old system.

An egocentric effect, much like that found with promote/nonpromote status, was found when using term of enlistment as the independent variable. Third termers favored giving more importance to time in service, while first term airmen did not. First term airmen placed more value on the Specialty Knowledge Test.

Aptitude test scores of airmen, who felt that WAPS tests should be increased in importance, were higher than those for airmen who would give the tests less weight. However, lower aptitude personnel rated Specialty Knowledge Tests current and adequately covering the career field. As a test, the SKT was regarded more favorably by the lower aptitude group than by their higher aptitude peers. (8 pp.)

247 **Black, D.E. Development of the E-2 weighted airman promotion system. AFHRL-TR-73-3, AD-767 195. Lackland AFB, TX: Personnel Research Division, April 1973. Project 6323. NTIS.** To conform with new Air Force requirements for grade and promotion controls, the Air Training Command found it necessary to develop a fair and visible system for selecting the top 15 percent of each Basic Military School class for promotion to E-2 upon completion of training. A candidate system was developed by the Personnel Research Division of the Air Force Human Resources Laboratory in a policy capturing study in which a six-man promotion policy board was convened to rank-order a representative BMT airman sample for promotion. The rankings performed by the board were done with respect to each trainee's promotability taking into account the following five promotion factors identified by ATC: The average score on the AFQT and four AQEs; the overall grade on the 25th day of training proficiency evaluations; the BMT written examination; the Military Training Instructor recommendation score; and the student leader score. Using regression analysis, each board member's promotion policy was expressed in terms of a mathematical equation, and the system of regression weights developed for each board member was used in deriving, by a hierarchical grouping method, the overall policy representing a consensus on the promotion policy. In general, there was high intra-rater consistency throughout the large number of records reviewed by board members. The derived promotion policy equation weights efficiently replicated the individual policies of a majority of board members. This paper describes the composition and operation of the policy board, the sample of Basic Military Training personnel records which were examined, and the statistical analysis. The final recommendations made to ATC are also included, but do not necessarily reflect the final adopted promotion policy since subsequent policy considerations may, of necessity, require an operational scheme that departs from these findings. (20 pp.)

248 **Shenk, F., Watson, T.W., & Hazel, J.T. Relationship between personality traits and officer performance and retention criteria. AFHRL-TR-73-4, AD-767 198. Lackland AFB, TX: Personnel Research Division, May 1973. Project 7719. NTIS.** The study concerns an examination of three self-report personality inventories (FCSRI-A, FCSRI-B, DAI) and a Peer Rating Scale designed to measure five personality factors: Surgency, Agreeableness, Conscientiousness, Emotional Stability, and Culture. Regression analysis techniques were applied using these measures to predict retention and officer effectiveness as measured by Officer Effectiveness Reports (OERs). Analysis of the data indicated that measurements based on the Peer Ratings had higher predictive value for both criteria than the factor scores derived from the paper-and-pencil personality tests which rarely reached significance levels. Furthermore, peer ratings had a higher level of prediction for officer performance than retention. A regression equation including the self-report inventories, peer rating factors, and peer rating traits yielded an R of .19 for retention and an R of .36 for officer performance measures. When grade, Duty Air Force Specialty Code (DAFSC) and education were included as predictor variables, the correlations were .39 for retention and .43 for the OER rating. (15 pp.)

249 **Phalen, W.J., & Christal, R.E. Comprehensive occupational data analysis programs: group membership (GRMBRS/GRPMBR) and automated diagramming (DIAGRM) programs. AFHRL-TR-73-5, AD-767 199. Lackland AFB, TX: Personnel Research Division, April 1973. Project 7734. NTIS.** This technical report describes two Comprehensive Occupational Data Analysis Programs (CODAP): (*a*) the "Group Membership" (GRMBRS/GRPMBR) programs, which produce a report that identifies the two groups combining at each stage of a hierarchical grouping process, and (*b*) the "Automated Diagramming Cluster Merger" (DIAGRM) program, which uses GRMBRS information as input and displays the hierarchical grouping actions in diagrammatic form.

The detailed descriptions of the GRMBRS/GRPMBR and DIAGRM programs contained in this report should be of particular interest to agencies and organizations using the CODAP system. (11 pp.)

250 **Zagorski, H.J., Southworth, L.E., Charlston, S.E., Grace, G.L., & Smith, R.L. Automatic data processing system and procedures computerized academic counseling system. AFHRL-TR-73-6, AD-767 196. Brooks AFB, TX: Professional Education Division, June 1973. Project ILIR, Contract F41609-71-C-0028, System Development Corporation. NTIS.** This report provides a technical analysis and review of the Computerized Academic Counseling System (CACS) designed and developed by the System Development Corporation. The system was constructed to assist counselors in guiding undergraduate college students toward the selection of optimal academic majors.

Problem review and definition, system analysis, design rationale, methodological approach, measurement specifications, data base compilation, mathematical modeling, statistical results, and validation tests are presented in various degrees of detail. Counseling application directions, capabilities, and potential are described.

Computerized academic counseling is discussed in the context of career success likelihood. Recommendations for extending the approach to include additional aspects of career guidance are made.

A concept for an Air Force career counseling system that effectively permits officers and airmen to shape their own careers is discussed. Functional components of the system include: (*a*) an Air Force personnel needs and resources forecast model, (*b*) a data base for the development and continuous support of the model, and (*c*) an Air Force mechanism which permits personnel to select careers of their choice and offers assurance that such careers will be obtained. Preliminary analyses indicate that such a system is entirely feasible and could have significant positive impact on Air Force enlistment and turnover rates. Recommendations are presented which suggest appropriate initial research and development stages. (46 pp.)

251 **Vitola, B.M., Mullins, C.J., & Croll, P.R. Validity of Armed Services Vocational Aptitude Battery, Form 1, to predict technical school success. AFHRL-TR-73-7, AD-767 578. Lackland AFB, TX: Personnel Research Division, July 1973. Project 7719. NTIS.** Validities of the four aptitude indexes of the Armed Services Vocational Aptitude Battery (ASVAB), Form 1, and the Airman Qualifying Examination-66 (AQE), were determined for final grades in 46 airman training courses. Comparisons were made between AQE and ASVAB in terms of their ability to predict technical school success. The data demonstrate that ASVAB is an effective instrument for use in the military high school testing program and may be used satisfactorily, as is AQE, to assign enlistees to technical training. Three of the four selector aptitude indexes of the ASVAB (General, Administrative, and Electronics) evidenced their appropriateness by having higher validities for their appropriate courses than any of the other ASVAB aptitude indexes. This sort of specific validity did not obtain for the selector index of the Mechanical cluster. However, 15 of the 16 validities obtained for the selector index in the Mechanical area were at a significant (.01), useful and acceptable level. (17 pp.)

252 **Mullins, C.J., Vitola, B.M., & Abellera, J.W. A correlational analysis of drug abuse in the Air Force. AFHRL-TR-73-8, AD-770 017. Lackland AFB, TX: Personnel Research Division, July 1973. Project 7719. NTIS.** Information was collected on 4,689 subjects who admitted to having used drugs

before entering the Air Force. A correlational analysis of this sample indicated that there appears to be a general tendency to abuse several drugs if a subject has abused one, and that marijuana appears to be associated with multiple drug abuse more than any other drug. Extent of drug abuse of all drugs studied appears to be associated with low performance on aptitude measures and educational level. Other correlational analyses indicated that the only drug significantly associated with low Airman Performance Reports is marijuana, and that the pattern of optimal weights among background variables in forming prediction composites against Airman Performance Reports among drug abusers is not significantly different from the pattern of such weights among non abusers. (16 pp.)

253 **Guinn, N., & Germadnik, G.J. Feasibility of developing a procurement strategy for school of military sciences, officer input. AFHRL-TR-73-9, AD-770 018. Lackland AFB, TX: Personnel Research Division, August 1973. Project 7719. NTIS.** This report describes the origin and development of a data base for possible use in increasing the effectiveness of officer procurement for the School of Military Sciences, Officer training program. Distributions are included to illustrate the type and magnitude of differences existing between the various colleges and universities attended by entrants into SMS-O training. The relationships between officer effectiveness criteria and the characteristics of the colleges and universities from which the junior officers graduated were analyzed. Results of analyses indicate that criterion differences found are due to some extent to the differences in the characteristics of the academic institutions' student bodies. It is concluded that these data could be utilized effectively in SMS-O officer recruitment, and a combination of these data with similar data on current AFROTC detachments could be used to form the basis of a flexible, cost-effective procurement program. (19 pp.)

254 **Taylor, J.N., & Black, D.E. Nonprior service college graduate airmen responses to selected questions from the March 1971 airman sample survey. AFHRL-TR-73-10, AD-771 678. Lackland AFB, TX: Personnel Research Division, October 1973. Project 6323. NTIS.** The purpose of this study was to provide information on first term nonprior service college graduate (NPSCG) airmen by examining their responses to selected questions from the March 1971 Airman Sample Survey. Areas of interest included the availability and use of accelerated training in technical schools, job satisfaction, job effectiveness, and the value of college training to Air Force jobs. Comparisons were made between the responses of NPSCG airmen and first term noncollege graduate airmen and between NPSCG airmen assigned to various career fields. Results of the analyses indicated the following: NPSCG airmen had less opportunity for accelerated training than did noncollege airmen, but had significantly better results when such training was available. In most instances, however, the college graduates and the noncollege graduates did not attend the same technical schools in like proportions. Percentagewise, more college graduates were displeased with their Air Force jobs and considered their jobs dull than did noncollege graduate airmen. Most supervisors who held a college degree judged NPSCG airmen to be more effective in Air Force jobs than noncollege graduate airmen, while almost half of the supervisors without a degree thought there is no difference in the job effectiveness of either group. When considering the career fields most populated by NPSCG airmen, significant differences were found regarding the value of academic specialties to Air Force jobs. Also, it was determined that the value of academic specialties to Air Force jobs is highly related in a positive direction to job satisfaction. (24 pp.)

255 **Mitchell, R.L., Lucero, A.B., & Harrison, R.E. Simulation of high-resolution radar displays of city complexes. AFHRL-TR-73-11, AD-768 413. Wright-Patterson AFB, OH: Advanced Systems Division, August 1973. Project 6114, Contract F33615-72-C-1583, Technology Service Corporation. NTIS.** The modeling and simulation techniques capable of generating large-scale high-resolution radar displays of cultural features are investigated. Specific features include power transmission towers, buildings, railroads, bridges, storage tanks, streets, rivers, and natural terrain. In addition, the general background-type of return is also discussed. The problem of real-time simulation is assessed. The techniques have been applied to simulate radar images of a 2.25 x 2.25 mile area of North Long Beach, California, to a resolution of 20 feet. (110 pp.)

256 **Wilbourn, J.M. The Air Reserve as an all-volunteer force. AFHRL-TR-73-12, AD-773 804. Lackland AFB, TX: Personnel Research Division, September 1973. Project 7719. NTIS.** The Air Reserve force, consisting of the Air Force Reserve (USAFR) and the Air National Guard (ANG), is facing a critical period of adjustment with the advent of the all-volunteer force. If the Air Force is unable to attract sufficient numbers of personnel into the Regular Air Force to satisfy mission requirements, or if additional personnel are required in case of a national emergency, the role of the Reserve force becomes one of primary importance. In order to assess the effect of an all-volunteer concept on the Reserve force, an attitude survey was administered to a random sample of USAFR and ANG non-prior service 1970 enlistees to determine their attitudes and opinions about the military in general and the Air Force in particular. Biographical, socio-economic, aptitudinal and attitudinal data were analyzed by draft vulnerability category and expressed attitude toward volunteer military service. Analyses indicated a general lowering of aptitude and educational level in the reduced quantity of enlistees who will volunteer for Reserve duty. However, intensified recruitment of minority groups, which now constitute less than five percent of the Reserve force, might supplement any projected decrease in numbers of enlisted accessions. Various negative aspects such as military discipline, salary, and interference with civilian job were indicated as contributing factors to non-reenlistment in the Reserve force. A survey of inducements to reenlist as preferred by the sample indicated increased pay, veteran's benefits on retirement, and reenlistment bonuses may be effective in increasing Reserve retention rates. Certain non-monetary benefits such as completion of education at the government's expense, or guaranteed promotions may be quite effective in inducing prospective Reserve enlistees to volunteer for the Regular Air Force in lieu of their Reserve tour. (19 pp.)

257 **Fugill, J.W.K. Task difficulty and task aptitude benchmark scales for the administrative and general career fields. AFHRL-TR-73-13, AD-771 677. Lackland AFB, TX: Personnel Research Division, October 1973. Project 7734. NTIS.** This, the second report on the development of task difficulty and task aptitude benchmark scales, discusses the feasibility of inferring relative task difficulty values and relative task aptitude requirements for a variety of tasks in the General and Administrative work areas. It was established that there was a high positive relationship between relative task difficulty values, as designated by work supervisors, and the corresponding relative task aptitude requirements, as determined by behavioral scientists. For 3,200 tasks not used in the original scaling procedure, it was determined that relative task difficulty values may be inferred at a high level of confidence, and that relative task aptitude requirements may be inferred at a moderately high level of confidence. (14 pp.)

258 **Mullins, C.J., & Massey, I.H. An evaluation of item-by-item test administration. AFHRL-TR-73-14, AD-764 178. Lackland AFB, TX: Personnel Research Division, May 1973. Project 7719. NTIS.** A battery of three tests was administered to two groups of basic airmen in their first week of basic training. Group A (N = 298) was tested in the normal way; Group B (N = 317) was tested with an item-by-item form of administration. The purpose was to determine whether the item-by-item administration would be more efficient than the usual method. Results did not indicate that the item-by-item administration was in any way superior to the usual. (4 pp.)

259 **Miller, G.G., & Sellman, W.S. Development of psychometric measures of student attitudes toward technical training: norm group report. AFHRL-TR-73-15, AD-775 151. Lowry AFB, CO: Technical Training Division, October 1973. Project 1121. NTIS.** This report describes the Phase II effort of a task to develop a new student critique form for the Air Training Command (ATC). Phase I of this effort, as reported in AFHRL-TR-70-37, Development of Psychometric Measures of Student Attitudes Toward Technical Training: Reliability and Factorial Validity, recommended the further development of group specific norms for officers, NCOs, and airmen enrolled in Air Force technical training schools. In Phase II additional items were added to the prototype form resulting in a later

version of the critique form that had a reliability of .80. The Phase II version of the Student Critique Form (SCF) was administered to a sample of over 1800 students enrolled in technical training courses at six Air Force bases. Norms were gathered separately for officers, NCOs, and airmen since additional analyses indicated, as did the Phase I analyses, that the three groups were significantly different with respect to attitudes as measured by the SCF. Seven scales emerged from a factor analysis of the Phase II version of the SCF. The scales were named as follows: Instructor Competence, Study Environment and Testing, Specialty Training, Training Impressions, Classroom Facilities and Environment, Training Devices and Audio Visual Aids, and Training Materials Adequacy. Phase II of this effort was subsequently initiated to develop the computer software to score and interpret the SCF. (42 pp.)

260 **Headquarters Air Force Human Resources Laboratory. Fiscal year 1974 – Air Force technical objective document. AFHRL-TR-73-16, AD-766 646. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, July 1973. (Covers all AFHRL projects). NTIS.** This document provides the academic and industrial R&D community with a summary of the technical planning objectives of the Air Force in the area of human resources. The objectives covered are (*a*) Personnel Procurement and Initial Assignment; (*b*) Personnel Utilization; (*c*) Education, Training and Instructional Systems; (*d*) Instructional Devices, Hardware and Software Development; (*e*) Performance Evaluation; (*f*) Sustainment, Separation and Retirement; and (*g*) Human Resources Data in Systems Design and Operation. (25 pp.)

261 **Koplyay, J.B., Gott, C.D., & Elton, J.H. Automatic interaction detector-version 4 (AID)–4 reference manual. AFHRL-TR-73-17, AD-773 803. Lackland AFB, TX: Personnel Research Division, October 1973. Project 6323. NTIS.** A computer-based automatic interaction detector (AID-4) algorithm was adapted and amended for Air Force use by the Air Force Human Resources Laboratory from an earlier program obtained from The University of Michigan. The basic idea of AID-4 is to explain variance of a criterion variable in terms of given predictor variables and their possible simple and complex interactions by a sequential splitting process. This report describes the technical details that are required for the use of the AID-4 program as it is currently operational on an IBM 70-40 computer system. (98 pp.)

262 **Siegel, A.I., Bergman, B.A., & Miller, G.G. Adaptation of advanced measurement and evaluation techniques for utilization in Air Force technical training systems. AFHRL-TR-73-18, AD-773 802. Lowry AFB, CO: Technical Training Division, November 1973. Project 1121, Contract F41609-72-C-0014, Applied Psychological Services, Inc. NTIS.** The multidimensional scaling and cluster analytic techniques were investigated as methods for providing a needed integrating framework within the course development and training evaluation context. Additionally, the relative merit was investigated of various advanced (novel) testing methods in the technical training context. The multidimensional and the cluster analytic techniques were held to provide the needed integrating thread and the advanced testing methods were indicated to posses advantage over the usual multiple choice examination. (142 pp.)

263 **Guinn, N., Farmer, C.B., & Wilbourn, J.M. Effect of an all-volunteer force on input into the school of military sciences, officer training program. AFHRL-TR-73-19, AD-775 714. Lackland AFB, TX: Personnel Research Division, December 1973. Project 7719. NTIS.** To determine the impact of the volunteer force on officer accessions, a total of 3,931 trainees entering the school of Military Sciences, Officer training program during FY 1972–1973 were surveyed and categorized into groups based on draft vulnerability and expressed attitude toward voluntary military service, prior service experience, rated/non-rated status, and entry before and after November 1971. Results indicate that NPS officer trainees are motivated to some extent by draft pressure. In general, prior service personnel and minority groups express a more favorable attitude toward voluntary military service.

An increase in positive attitude is also perceptible after the military pay increase became effective. Comparisons on other demographic, aptitudinal, and attitudinal variables revealed significant differences between self- and draft-motivated trainees and between prior and non-prior service personnel. (32 pp.)

264 **McLaurin, W.A. Validation of a battery of performance tests for prediction of aerospace ground equipment course grades. AFHRL-TR-73-20, AD-774 586. Lackland AFB, TX: Personnel Research Division, November 1973. Project ILIR, Contract F41609-71-C-0032, University of Alabama in Birmingham. NTIS.** A battery of nine performance tests (Performance Assessment System, PAS) was administered to 204 airmen trainees enrolled in an Aerospace Ground Equipment Repairman (AGE) course at Chanute Air Force Base, ATC. The objectives of the research program were to determine the validity of the PAS tests for criterion course grades; to determine the increase in validities for the course grades by combining the PAS scores with the AQE Electronic AI and to determine the validity of the PAS tests for the course grades of "low-aptitude" airmen.

Analyses of the data indicated that the PAS tests made a significant contribution to the Electronics AI in predicting course grades, and, for most course grades, the PAS tests were equal in validity to the Selector Index. The PAS tests, in general, made more contribution to the grades based upon trouble-shooting and repair problems than did the other predictors. The sample of trainees, were separated into upper and lower groups based upon AFQT percentile rank. The validities of the AFQT, AQE indexes and PAS tests were determined for each resultant group. The PAS tests were approximately equal in validity to the other predictors for criterion course grades for the upper group and superior to them for the lower group. Recommendations for subsequent research and development are given. (19 pp.)

265 **Askren, W.B., Korkan, K.D., & Watts, G.W. Human resources sensitivity to system design tradeoff alternatives: feasibility test with jet engine data. AFHRL-TR-73-21, AD-776 775. Wright-Patterson AFB, OH: Advanced Systems Division, November 1973. Project 1124. NTIS.** The feasibility of developing Design Option Decision Trees to a level of detail which shows hardware involved in "on-aircraft" maintenance, and the feasibility of measuring the sensitivity of human resources data to design tradeoff problems depicted in these Trees were investigated. The approach included expanding a portion of an earlier developed aircraft jet engine Tree, selecting tradeoff problems from the expanded Tree for sensitivity analysis, and collecting psychometric data from experienced jet engine mechanics regarding this sensitivity. Five Design Option Decision Trees were developed for turbofan jet engines. Eight turbofan problems were evaluated for effect on human resources. The factors of training and experience, and amount of troubleshooting time are affected by choice of design option in six of the eight tradeoff problems. Ease of maintenance is affected in five problems, and complexity of tools and equipment is affected in two problems. Crew size and job specialty are each affected in one problem. (37 pp.)

266 **Mays, J.A., & Irish, K.M. The development and evaluation of an optimized video output from a wide angle optical probe. AFHRL-TR-73-22, AD-774 577. Wright-Patterson AFB, OH: Advanced Systems Division, December 1973. Project 6114, Contract F33615-72-C-1270, Systems Research Laboratories, Inc. NTIS.** This report describes a two-phase program to develop an optimized video output from a wide angle optical probe. Phase I of the program presents data resulting from radiometric and photometric studies of model paints, textures and illumination sources; performance data resulting from tests conducted on the wide angle optical probe; and a preliminary system design. Phase II of the program dealt with system development and evaluation. The report describes the detailed design of the high resolution 2-inch vidicon camera, including particular emphasis on the wideband video preamplifier and video processing electronics. The evaluation phase of the program includes data concerning the performance of the television system, and the performance of the integrated system including the optical probe, magnifying image intensifier and ultra high resolution

2-inch vidicon camera. The conclusion reached by examination of the resultant data supports the belief that a truly optimized video output from a wide angle optical probe has been achieved. (143 pp.)

267 **Vitola, B.M., Mullins, C.J., & Brokaw, L.D. Comparative data on a sample of all-volunteer enlistees with 1970 through 1972 Air Force accessions. AFHRL-TR-73-26, AD-767 579. Lackland AFB, TX: Personnel Research Division, July 1973. Project 7719. NTIS.** A data base was established to which characteristics of the all-volunteer force could be compared. If the hypothesis is tenable that the sample of 1973 enlistees used in this study represents the qualitative characteristics of the all-volunteer force, current aptitude levels suggest sufficient quality for the majority of Air Force jobs. Analysis of the data resulted in the following conclusions: (*a*) There has been a gradual loss of high aptitude people over a three-year period. If this trend continues, there will be a probable need to offer further incentives to enlist individuals who can perform in the more critical aptitude areas. (*b*) There will be no dramatic increase in the proportion of Negroes in the all-volunteer force. Air Force has enlisted, and continues to enlist, a proportion of Negroes equal to, or greater than, the proportion of Negroes in the population. (*c*) Under present reenlistment policy considerations, Air Force will remain an excellent source from which industry may draw skilled personnel in over 200 job types. (13 pp.)

268 **Askren, W.B. Analysis of Air Force institute of technology course #475 "Laboratory Management of R&D." AFHRL-TR-73-27, AD-767 197. Wright-Patterson AFB, OH: Advanced Systems Division, August 1973. Project 1124. NTIS.** The Air Force Institute of Technology Course #475, "Laboratory Management of Research and Development" was analyzed to determine if such a course is needed, what form it should take, and what subjects should be included in the curriculum. The analysis also provides other supplementary data. It was found that Laboratory Commanders are in favor of retaining the course but believe it should be changed. The study recommends that the course be continued reoriented to training the new laboratory scientist/engineer regarding the duties of this job, that the course be shortened to a maximum of 15 days using 21 priority subject matter topics, and that a Laboratory Project Engineer Handbook be developed to supplement the course. The study also recommends that a DOL Course Advisory Group be established to monitor the course content and objectives. This analysis applies to Course 475 as it was taught through June 1972. The course was revised subsequent to that date based partially on the findings of this study. Inquiries concerning the current AFIT/SL Course 475 content and method of instruction should be addressed to the Chief, Continuing Education Division, AFIT School of Systems and Logistics, Wright-Patterson Air Force Base, Ohio 45433. (45 pp.)

269 **Guinn, N., & Truax, S.R. Comparison of volunteer attitudes and career motivation among officer and airman personnel. AFHRL-TR-73-28, AD-772 676. Lackland AFB, TX: Personnel Research Division, October 1973. Project 7719. NTIS.** Should problems arise in procuring a sufficient number of qualified personnel to maintain viable force levels under zero-draft condition, it becomes necessary to identify incentive programs which could be used to stimulate recruiting effort. A total of 3,391 officer trainees and 9,333 basic airmen entering service during fiscal year 1972 were surveyed to determine the effect of certain incentives on their attitude toward voluntary military service and the perceived positive and negative aspects of a military career. Results indicate that the *choice of career field incentive* had the greatest impact on expressed volunteerism for officer personnel. *Career field choice* and *variable term of service commitment* had an equally positive influence on airman attitudes. From an officer quality standpoint, pay, promotion, and educational incentives attract officers of quality similar to those whose negative attitudes toward voluntary military service remain unchanged. For airman personnel, those attracted by the pay incentives demonstrate higher performance in all aptitude areas than those with a negative attitude toward military service. Airman and officer personnel differ in their perception of the most satisfying aspects of a military assignment. *An interesting job* was the factor most widely selected as a satisfier by officers, *opportunity for*

technical training by airmen; the outstanding dissatisfier for both groups was *perceived lack of personal control over their career. Isolated tours* and *separation from family* were perceived as the most negative aspects of an Air Force career. (29 pp.)

270 **Croll, P.R., Mullins, C.J., & Weeks, J.L. Validation of the cross-cultural aircrew aptitude battery on a Vietnamese pilot trainee sample. AFHRL-TR-73-30, AD-778 072. Lackland AFB, TX: Personnel Research Division, November 1973. Project 7719. NTIS.** The present study is validation of the Cross-Cultural Aircrew Aptitude Battery (CCAAB) with a Vietnamese pilot trainee sample. Results of this study indicate that the CCAAB is an acceptable predictor of pilot success for foreign national pilot candidates, and that optimum prediction is obtained when predictor sets and regression weights are nationality-specific. Recommendation is made to re-validate the CCAAB on each nationality for which it is to be used, in order to determine the unique optimum predictor sets and weights for that nationality. (13 pp.)

271 **Wilbourn, J.M., & Guinn, N. Feasibility of using special measures in the classification and assignment of lower mental ability airmen. AFHRL-TR-73-31, AD-777 831. Lackland AFB, TX: Personnel Research Division, November 1973. Project 7719. NTIS.** A battery of eleven non-verbal tests were administered to a sample of 2,362 non-prior service enlistees who had been selected to one of seven technical schools. The usefulness of additional aptitudinal and educational data was also investigated. The number of significant relationships between certain non-verbal tests and final technical school grade varied as a function of mental category and career field. When all non-verbal tests were used as a composite, significance was found in all courses for the total group and in three of five courses for the lower mental ability groups. On cross-validation the number of significant relationships between the non-verbal composite and final school grade were reduced to four total group courses and one lower ability group course. When added to the selector aptitude index (AI), the non-verbal tests made a significant and unique contribution to the prediction of technical school success over and beyond the selector AI alone. Further investigation indicated that additional aptitudinal and educational data added significantly to the prediction system in some courses.

Results indicate that the use of non-verbal tests as well as other aptitudinal and educational data could make a significant contribution if added to the operational selection and classification battery. (20 pp.)

272 **Mullins, C.J., Vitola, B.M., & Michelson, A.E. Variables related to pre-service cannabis use in a sample of Air Force enlistees. AFHRL-TR-73-33, AD-776 778. Lackland AFB, TX: Personnel Research Division, November 1973. Project 7719. NTIS.** A sample of 4,564 self-admitted cannabis users was compared with a sample of airmen who had no known record of drug abuse. This study indicates that there is a very strong likelihood for cannabis users to use other drugs. There are relationships between cannabis abuse and geographic area of enlistment, religious preference, aptitude scores, race, educational level, and age at enlistment. Cannabis abuse is also related to the likelihood of getting an undesirable discharge, to Airman Performance Report, and to promotion rate. (41 pp.)

273 **Carpenter, J.B. Relative validity of two item formats for obtaining length of service data from job inventories. AFHRL-TR-73-34, AD-771 673. Lackland AFB, TX: Occupational Research Division, September 1973. Project 7734. NTIS.** As part of a continuing effort to improve existing methodology for development and use of occupational data gathering devices, this report considers the relative validity of two varied item formats for obtaining length of service data; specification in total months versus a combined years and months formulation. The later format was found to have much greater validity for relatively lengthy time periods but no significant difference was found for shorter periods. An alternative method for obtaining length of service data which employs a computer determination of elapsed time based on respondent provided dates is recommended for operational use. (6 pp.)

274 **Carpenter, J.B. The electronic career ladder evaluation project: an aptitude requirements study. AFHRL-TR-73-35, AD-774 576. Lackland AFB, TX: Occupational Research Division, December 1973. Project 7734. NTIS.** In the event that anticipated shortfalls in the recruitment of qualified airmen for certain electronic specialties materializes, data on existing job requirements in terms of electronic aptitude requirements should provide the basis for any selective lowering of the minimum AFS standards. This report considers the relative electronics aptitude requirements for all AFSCs having a specified minimum AQE-EI. Ranked difficulty of first-term airmen jobs in these specialties, in terms of electronics aptitude required, were obtained from 1,323 NCO supervisors and compared with the existing requirements. The rankings were shown to be highly stable and reliable, and the validity of the experimental procedures is supported by the data. Sequential actions for lowering the minimum electronics aptitude requirements together with a realignment of existing AFSC requirements are suggested. (11 pp.)

275 **McFarland, B.P. Job analysis of the medical service career field. AFHRL-TR-73-36, AD-775 720. Lackland AFB, TX: Occupational Research Division, January 1974. Project 7734. NTIS.** The purpose of this study was to complete a job analysis of the Air Force's Medical Service Career Field. This is the first in a series of reports designed to compare and make recommendations concerning the role of the Nurse and Medical Corpsman in the Air Force's health care delivery system. A sample of 1,996 airmen in the Medical Service Career Field (AFSC 902X0, 90292) was used for the analysis. The data were analyzed by use of the Comprehensive Occupational Data Analysis Programs (CODAP). Meaningful job types were identified and recommendations for changing the structure of the Medical Service Career Ladder were made based on the occupational analysis.

The job inventory for the Medical Service Career Field was constructed and administered by Lifson, Wilson, Ferguson, and Winick, Inc., under contract F41609-70-C-0043 monitored by the Air Force Human Resources Laboratory's Occupational Research Division (7734-01-12).

Consolidated descriptions of job type groups, together with other pertinent printout data, are available to qualified requesters on a loan basis from the Air Force Human Resources Laboratory's Occupational Research Division/PEOA, Lackland AFB, Texas 78236. (18 pp.)

276 **Carpenter, J.B., & Christal, R.E. Development of a data base for direct analysis of airmen loss rates. AFHRL-TR-73-37, AD-775 721. Lackland AFB, TX: Occupational Research Division, December 1973. Project 7734. NTIS.** This study was designed to accomplish two interrelated objectives: first, to investigate the existing relationship between selected factors previously identified as being significant in attempting to predict military service losses during first-term service and second, to make available to qualified users a comprehensive data base for further analysis as specific questions in this area arise. The data base developed is described in detail and methodologies for interpretation are suggested in an analysis of the effects of mental category classification, age, and pre-service education level on potential airman attrition for undesirable causes. All factors cited were found to show a significant relationship with the existing loss rate of first-term airmen. (23 pp.)

277 **Echternacht, G.J., Reilly, R.R., & McCaffrey, P.J. Development and validity of a vocational and occupational interest inventory. AFHRL-TR-73-38, AD-774 573. Lackland AFB, TX: Personnel Research Division, December 1973. Project ILIR, Contract F41609-72-C-0030, Educational Testing Service. NTIS.** Between January and April 1973, over 3,100 airmen in eight service career fields with at least six months on-the-job experience and 300 recruits in basic training returned interest inventories, termed the Vocational and Occupational Interest Choice Examination (VOICE). This interest inventory was designed to measure the vocational interests of enlisted men entering the Air Force. Items forming the inventory were primarily generated by examining job analyses in relation to the airman classification structure. The purpose of this effort was to develop and validate a prototype of an interest inventory that could be used by recruiters with the Guaranteed Enlistment Program.

Both a priori and occupational scales were developed based on responses obtained by mail inventory administration of airmen who indicated satisfaction with their career fields. Scales were developed on half-samples and a cross-validation technique employed. A comparison was made, in order to assess validity, of the number of individuals correctly predicted to be members of a service career field or "men-in-general" using the scales versus the number of individuals one would expect to correctly predict without use of the scales. Scale weights developed in one half-sample were applied to responses obtained in the other half-sample in the above comparison. Recommendations for further developmental effort were made. (83 pp.)

278 **Frick, F.C., & Karp, D. Use of the lincoln training system for the task simulation in the support of performance laboratory instruction. AFHRL-TR-73-39, AD-764 724. Lowry AFB, CO: Technical Training Division, September 1973. Project 1121, Contract F19628-70-C-0230, Massachusetts Institute of Technology. NTIS.** An investigation was carried out to determine the feasibility and relative cost of developing pictorial procedures that could be used in conjunction with the Lincoln Training System for task simulation in the support of performance laboratory instruction. The technique appears to be economical and effective. The storage and data processing capabilities of the LTS make it possible to monitor and assess the student's performance. It would also be possible to record and monitor system performance in the same fashion, and a scheme for "system performance assurance" is developed which capitalizes on this capability. (28 pp.)

279 **Scheffler, F.L., DaPolito, F.J., McAdams, R.L., & Gee, M.J. Feasibility of computer processing of technical information on the design of instructional systems. AFHRL-TR-73-40, AD-778 073. Wright-Patterson AFB, OH: Advanced Systems Division, January 1974. Project 1710, Contract F33615-72-C-2091, University of Dayton Research Institute. NTIS.** A study was made of the feasibility of a computer-based system to handle technical information pertinent to the design and use of instructional systems. The study took into account the information needs of both researchers and practitioners. Current and projected information needs of researchers and practitioners were determined from structured interviews. Ten available computer-based information storage and retrieval systems which could serve as a basis for such a technical system were investigated. Question-answering computer systems based on artificial intelligence concepts were reviewed and considered in terms of providing a prescriptive interactive system. It was concluded that practicable generalized semantic information retrieval systems would require further developments. The design and implementation of a natural language automated information retrieval system encompassing rudimentary features of a prescriptive system is feasible, both in terms of the technical resource provided and its cost effectiveness. An on-line interactive retrieval system was designed, and a model data base of approximately 500 literature-derived comprehensive abstracts was implemented and tested to confirm the feasibility of the system. (114 pp.)

280 **Schumacher, S.P. Development of a technical data file on the design and use of instructional systems. AFHRL-TR-73-41, AD-775 149. Wright-Patterson AFB, OH: Advanced Systems Division, December 1973. Project 7907, Contract F33615-72-C-1884, Applied Science Associates, Inc. NTIS.** This report describes the development of a technical data file concerned with the technology of Instructional System Development suitable for a variety of users. The file was prepared in a way amenable to later computerized storage and retrieval. General information sources and indexes of highly probable relevant content were reviewed with key words and relevant specialty journals covering the period 1950 to 1973 were searched. Abstracts of articles providing opinion, new methodology, evaluative summary and literature review were of a summarizing descriptive nature. Abstracts of articles reporting sampling studies, correlational analysis, and experimental data were prepared more comprehensively so that they might often be used in lieu of the article. A common format was used with a bibliographic/indexing information page and an evaluation checklist being included. The principal results of the effort are as follows: (1) a paper file of 2,693 abstracts, (2) a

card file of titles, (3) a coordinate index, (4) a comprehensive key word index and bibliography, and (5) MTST tapes of 1,950 of the abstracts. Incidental to the development, comprehensive guidelines for abstracting this type of literature and a compendium of author-noted research-and-development needs were prepared. (75 pp.)

281 **Guinn, N. Factors related to adaptability to military service among 1965 airman accessions. AFHRL-TR-73-42, AD-768 328. Lackland AFB, TX: Personnel Research Division, September 1973. Project 7719. NTIS.** Distributions were accomplished to demonstrate the relationships between age, educational level, and AFQT scores of the 1965 airman accessions and their reenlistment desirability at the completion of their initial tour. The largest percentage of undesirable enlistees was found in the high school non-graduate, Category IV, and 17 year old groups. Using these three categories of variables, it was found that it would be possible to eliminate 34 percent of the undesirables, although 76 percent of the individuals falling in this three category group actually proved to be successful in their military career. It was emphasized that caution should be used in attempting to establish a screening procedure to identify undesirable enlistees since a significant number of potentially qualified personnel might be excluded at the same time. (18 pp.)

282 **Joyce, R.P., Chenzoff, A.P., Mulligan, J.F., & Mallory, W.J. Fully proceduralized job performance aids: draft military specification for organizational and intermediate maintenance. AFHRL-TR-73-43(I), AD-775 702. Wright-Patterson AFB, OH: Advanced Systems Division, December 1973. Project 1710, Contract F33615-73-C-4033, Applied Science Associates, Inc. NTIS.** This volume supplies a model for specifications for the preparation of Fully Proceduralized Job Performance Aids for the maintenance of Air Force equipment. The model reflects the research findings of the Air Force Human Resources Laboratory and other Department of Defense agencies concerning maintenance data. It has the unique feature of requiring that a task analysis yielding certain intermediate products necessary for the development of this type of data be prepared in a standard format and submitted for review by the Procuring Agency. These intermediate products include items such as an Annotated Task Identification Matrix, a Test Equipment and Tool Use Form, and a Generalized Task List, as well as step description worksheets and level of detail requirements. The Aids to be developed from these specifications are for the organizational and intermediate maintenance functions: Adjust, align, calibrate, checkout/troubleshooting, clean, disassemble/assemble, inspect, lubricate, operate, remove/install, repair, and service. The specification, covers all content, writing, illustration, and format requirements for Job Guide Manuals and Fully Proceduralized Troubleshooting Aids. It includes comprehensive quality assurance provisions and an approved verb list. (153 pp.)

283 **Joyce, R.P., Chenzoff, A.P., Mulligan, J.F., & Mallory, W.J. Fully proceduralized job performance aids: handbook for JPA developers. AFHRL-TR-73-43(II), AD-775 705. Wright-Patterson AFB, OH: Advanced Systems Division, December 1973. Project 1710, Contract F33615-73-C-4033, Applied Science Associates, Inc. NTIS.** This volume provides guidance for the development of Fully Proceduralized Job Performance Aids (JPAs) for the organizational and intermediate maintenance of Air Force equipment. It contains detailed instructions to the contractor for preparing fully proceduralized JPAs in accordance with the Draft Specification (Volume I of this technical report). It includes instructions for performing the behavioral task analysis, for development of the Job Guides and Fully Proceduralized Troubleshooting Aids (FPTAs), and for insuring quality and accuracy assurance. The very important validation and verfication activities are also thoroughly discussed. Personnel types and qualifications required for efficient development of JPAs are also included. In addition, this volume presents a strategy and guidance for developing supervised practice exercises designed to produce the skills required for preparing fully proceduralized JPAs. (132 pp.)

284 **Joyce, R.P., Chenzoff, A.P., Mulligan, J.F., & Mallory, W.J. Fully proceduralized job performance aids: handbook for JPA managers and training specialists. AFHRL-TR-73-43(III), AD-775 706. Wright-Patterson AFB, OH: Advanced Systems Division, December 1973. Project 1710, Contract F33615-73-C-4033, Applied Science Associates, Inc. NTIS.** This report provides guidance for the Air Force Data Managers charged with responsibility for the procurement of Fully Proceduralized Job Performance Aids (JPAs). It provides guidelines, suggested procedures, and checklists for use by data managers in the review and assessment of the subproducts, intermediate products, and JPAs produced in accordance with the draft specification contained in Volume I of the Technical Report. It also provides guidance to Air Force Training Specialists in development of training coordinated with JPAs, and in specifying the appropriate JPA/training trade-off for new equipment systems. (70 pp.)

285 **Bleistein, S., & West, A.S. Simulating CMI on a mini-computer. AFHRL-TR-73-44, AD-772 674. Lowry AFB, CO: Technical Training Division, November 1973. Project 1121, Contract F41609-72-C-0005, University of Denver. NTIS.** A prototype computer based instructional system has been developed to demonstrate a computer managed learning environment. In addition to its capabilities for managing, monitoring, and delivering individualized instruction as part of a multi-media instructional system, the system provides the mechanism for experimentally examining hypotheses, i.e., instructional strategies and media preference. This guide to the use of the CMI describes the hardware configurations, some of which were developed and interfaced under other tasks performed under the same contract, and the software packages written to operate the hardware and to develop course material for computer based delivery. Sample report sheets are included to demonstrate the monitoring capabilities of the system. Two courses are described to show how lesson materials are prescribed to accommodate individual differences in aptitude, motivation, progress, and preference, and the ways in which student progress can be measured by instructors and authors of course and test material. (29 pp.)

286 **Lasota, P.E. Test and evaluation of multi-media cadet career information and counseling center. AFHRL-TR-73-45, AD-771 667. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, October 1973. Project HRLP, United States Air Force Academy. NTIS.** This research tests the effect of multi-media presentations as a supplement to the counseling process. The limits of this study have been set to test the impact of multi-media presentations for career information to cadets who are seeking counseling assistance for their initial Air Force assignment. The career decision process can be enhanced by TV cassettes. Career information materials can be made interesting and entertaining. TV cassettes have opened new parameters in the multi-media and counseling fields. There are many uses for this system in recruiting, technical training, School Military Science (Officer) and ROTC. Costs are not as prohibitive as some anticipated. Some counselor time can be released because the vast majority utilizing this system did not seek counseling assistance. Users believe the outside experts more readily than members of the Academy "establishment." (14 pp.)

287 **Askren, W.B. Human resources and personnel cost data in system design tradeoffs: and how to increase design engineer use of human data. AFHRL-TR-73-46, AD-770 737. Wright-Patterson AFB, OH: Advanced Systems Division, October 1973. Project 1124. NTIS.** A number of studies performed over a period of several years regarding the use of human resources and personnel cost data in system design tradeoffs were analyzed and the results integrated. Five questions were posed and answered. What are system design tradeoffs? What are human resources data? Why should military psychologists be interested in system design tradeoffs and human resources data? How much effect do system design tradeoffs have on human resources and personnel cost? And, what does this have to do with increasing engineer use of human data in design activities? The following conclusions were derived. Tradeoffs are a significant part of the weapon system design process. The choice of design alternative in a tradeoff study would, in many cases, substantially affect the human resources of the organization

using the product of the design. It is feasible to use data describing these human resources in design tradeoffs. This use could lead to development of products which make less demand on those resources. Viewing system design as a human decision process involving choice points and options, gives the psychologist an orientation toward design which allows him to more effectively work with the engineer. (19 pp.)

288 **Chenzoff, A.P. Evaluative study of the content and display of new and existing technical data to support Air Force maintenance. AFHRL-TR-73-47, AD-915 233. Wright-Patterson AFB, OH: Advanced Systems Division, November 1973. Project 1710, Contract F33615-71-C-1734, Applied Science Associates, Inc. NTIS.** Analyses were made to compare job performance aids (JPAs) and technical orders (TOs) in terms of the process by which they are developed, their contents, and their production costs. Throughout the comparisons, some attention was given to the functions that each type of technical data best supports. In comparison to TOs, JPAs are developed by a more rigid process which starts with systematic descriptions of maintenance tasks and personnel. In content, JPAs normally have many more illustrations, more blank space and a simple standard format for rather detailed directions. Currently available cost data do not support any substantive conclusions about the initial and long term relative costs of TOs and JPAs for a given system.

Additional pertinent conclusions were: (1) Any technical data system used by maintenance men must include an illustrated Parts Breakdown, (2) Provicing both JPAs and TOs to a given maintenance technician would not be optimal, (3) Technical data should be developed according to a systematic procedure which includes task analysis and a description of the users, (4) Future technical data should be adaptable to various modes of presentation, (5) Unambiguous guidance for the performance of troubleshooting tasks is highly desirable, (6) Illustrations and standard language increase the utility of technical data for maintenance. (127 pp.)

289 **Taylor, C.L., Roberts, K.C., & Smith, P.E. Use of inferred objectives with non-objectives based instructional materials. AFHRL-TR-73-48, AD-769 977. Williams AFB, AZ: Flying Training Division, October 1973. Project 1123, Contract F41609-71-C-0027, Arizona State University. NTIS.** This experiment was conducted to determine the effects of providing learners with instructional objectives prior to instruction with non-objectives-based materials from which the objectives were inferred by the experimenters. Sixty-four university students were randomly assigned to one of four treatments in which they received either no objectives, a partial list of objectives, or a complete list of objectives for an instructional film viewed together by all groups. Mean scores on the 18-item criterion test, which contained one item per objective, were significantly higher for *Ss* receiving objectives than for *Ss* receiving no objectives. Learners who received partial lists of objectives performed equally well or slightly better on the test portion for which they received no objectives than did learners who received no objectives, thus indicating that presentation of objectives did not appreciably limit their attention to content not relevant to the objectives. (15 pp.)

290 **Williams, R.B., Looper, L.T., & Morton, R. Career area rotation model: user's manual. AFHRL-TR-73-49, AD-771 679. Lackland AFB, TX: Manpower and Personnel Systems Division, October 1973. Project 7906, Contract F41609-71-C-0034, Decision Systems Associates, Inc. NTIS.** The Career Area Rotation Model was designed as a managerial aid for investigating and evaluating the various and diverse policy interactions which impact on the deployability posture of the Air Force. This user's manual provides user-oriented documentation in sufficient detail to give the prospective user a complete grasp of the concepts and logic underlying the model. The presentation includes: (a) a comprehensive overview of the system; (b) a description of the system modules and the interrelationships of their inputs and outputs; (c) detailed instructions on input card formats, with appropriate discussion as to the relationship between input parameters and applications of the model; and (d) a description and explanation of reports generated by the model. (227 pp.)

291 **Hatch, R.S., Pierce, M.B., Nauta, F., & Pina, M. Training line simulator (enhanced version). AFHRL-TR-73-50(II), AD-779 952. Lackland AFB, TX: Manpower and Personnel Systems Division, March 1974. Project 7906, Contract F41609-72-C-0019, Decision Systems Associates, Inc. NTIS.** This report describes the technical aspects and potential applications of a computer-based model simulating the flow of airmen through basic training and entry-level technical training. The objective of the Training Line Simulator is to assess the impacts of alternative recruit classification and training policies under a wide variety of assumptions regarding the quality of recruits and the difficulty of training. Parameters accommodated by the model include mandatory as well as desirable course prerequisites, attrition, setback and washahead rates, class schedules and quotas, and a host of individual airman attributes. The model evaluates the effects of a given set of training parameters on a given recruit input by determining the maximum percent fills of training quotas, the size of the waiting lines for technical training courses, class sizes, student-instructor ratios and the numbers of setbacks, attritions, washaheads and unassigned basic training graduates at weekly intervals.

The Training Line Simulator is an entity simulation model with imbedded optimizations to obtain an optimal assignment of each week's basic training graduates to entry-level technical training. The assignment objectives accommodated by the model are: (1) maximum fill of quotas, (2) optimal adherence to user-specified shortage sharing policies if one or more quotas cannot be filled completely, and (3) maximum number of assignments meeting the most desirable prerequisities and minimum number of assignments at the least desirable or mandatory level. The model employs an asynchronous as opposed to incremental projection methodology to achieve execution efficiencies. (70 pp.)

292 **Dansereau, D.F., Evans, S.H., Wright, A.D., Long, G.L., & Actkinson, T.R. Factors related to developing instructional information sequences: phase I. AFHRL-TR-73-51(I), AD-777 832. Lowry AFB, CO: Technical Training Division, March 1974. Project 1121, Contract F41609-73-C-0023, Texas Christian University. NTIS.** This report represents Phase I of a two phased research effort directed toward the development and implementation of an objective methodology for determining effective instructional sequences for technical training material. Technical concepts embedded within technical material were subjected to Inscal Multidimensional Scaling to determine the complexity and concept interrelationships of unrevised material, presently employed in three Air Force technical courses. Revision of the material according to different principles of sequencing concepts was accomplished. Pictorial and print material versions to include corresponding pictorial and print multiple choice tests were developed. Additional measures included standard Cloze, concept Cloze, and concept similarity measures of student comprehension. Conclusions from three Phase I pilot studies conducted to select parameter values for the Phase II main experiment were: (1) technical material differed significantly in difficulty level on five performance measures. Two difficulty levels were selected for Phase II experimentation, (2) 45 sec presentation rate of stimulus materials in print versus pictorial modes led to median performance levels, thus avoiding "ceiling" and "floor" effects associated with other presentation rates, and (3) four instructional sequences were derived from Inscal methodology based upon several sequencing principles. Two sequences in addition to the unrevised Air Force sequence were selected for inclusion in the Phase II main experiment. (180 pp.)

293 **Dansereau, D.F., Evans, S.H., Actkinson, T.R., & Long, G.L. Factors relating to the development of optimal instructional information sequences. AFHRL-TR-73-51(II), AD-783 843. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-73-C-0023, Texas Christian University. NTIS.** Inscal multidimensional scaling was shown to be of value with respect to (1) defining the information complexity of technical material, (2) developing sequences of key concepts within technical material, and (3) providing an index of expert inter-rater consensus. When the Inscal measure is obtained after student exposure to the material, Inscal provides an indication of the correspondence between experts' understanding of concept interrelationships and students' understanding of concept interrelationships. Major findings from the final phase indicated

(1) alternative sequences of instructional material influenced student performance, (2) pictorial technical information sequences resulted in small performance differences when compared to verbal print sequences, (3) technical information difficulty debililated student performance, (4) student reading aptitude was significantly related to student performance under both pictorial and verbal print presentation modalities, and (5) instructional sequences did not interact with student aptitude. (40 pp.)

294 **Mockovak, W.P. An investigation and demonstration of methodologies for determining the reading skills and requirements of Air Force career ladders. AFHRL-TR-73-53, AD-777 834. Lowry AFB, CO: Technical Training Division, January 1974. Project 1121. NTIS.** This report investigates alternative approaches or methodologies that could be used to determine the reading skills and requirements of Air Force career specialties. Several of the methodologies reviewed have actually been applied in Army military occupational specialties, but the purpose of this study was to select and demonstrate a methodology which had the greatest potential for use within the Air Force. The methodology selected in this effort was applied to five technical courses at Lowry AFB, resulting in empirically determined reading requirement levels for those courses. A comparison of two methods used for predicting an individual's reading grade level from standardized test measures of general ability was also accomplished. (23 pp.)

295 **Mockovak, W.P. An analysis of Air Force reading improvement programs: results of USAF survey number 73-89. AFHRL-TR-73-54, AD-775 047. Lowry AFB, CO: Technical Training Division, January 1974. Project 1121. NTIS.** This report summarizes the results of a questionnaire that was sent to the education offices of 93 Air Force bases in the continental United States. The purpose of the questionnaire was to obtain objective information concerning the present status of Air Force reading improvement programs in an effort to obtain better insight into the type and degree of reading problems facing the Air Force. The information presented in this paper attempts to answer such questions as, how many airmen participate in reading improvement programs, what career fields have a significant number of low-ability readers, what reading improvement programs are available at different bases, what are the major reading problems encountered by Air Force personnel, and who has the responsibility for organizing and financing the reading programs? Finally, recommendations concerning the Air Force's reading improvement programs are also discussed. (19 pp.)

296 **Valentine, L.D., Jr., & Cowan, D.K. Comparability study of Armed Services Vocational Aptitude Battery scores from answer sheet and answer card administration. AFHRL-TR-73-55, AD-775 048. Lackland AFB, TX: Personnel Research Division, January 1974. Project 7719. NTIS.** Armed Services Vocational Aptitude Battery (ASVAB) Form 2 was standardized for Digitek answer sheets. In September 1973, the Digitek scoring facility at Randolph AFB will be inadequate to handle anticipated scoring load. Consequently, ASVAB answer forms have been redesigned for processing via a Hewlett-Packard mark-sense reader from IBM card size forms which are more compressed than was the Digitek form. Score comparability from administrations on the two answer forms was investigated.

It was found that the answer form change had negligible effect on average examinee performance overall score distributions, or correlations among the battery's tests. Significant interaction between initial ability (as measured by the AFQT) and answer form used was found for two tests (Word Knowledge and Coding Speed); however, the interaction did not follow a clearcut pattern. It was recommended that existing ASVAB conversion tables continue in use until completion of a full restandardization study. (14 pp.)

297 **Tuttle, T.C., & Hazel, J.T. Review and implications of job satisfaction and work motivation theories for Air Force research. AFHRL-TR-73-56, AD-782 443. Lackland AFB, TX: Occupational**

Research Division, January 1974. Project 7734. NTIS. The purpose of this report is to: (*a*) review certain major theories of work motivation, particularly as related to job satisfaction, (*b*) distill from such theories and other research, implications for an Air Force job satisfaction research program, and (*c*) provide a comprehensive bibliography of satisfaction/retention studies. The theoretical positions considered were Two-Factor, Equity, Instrumentality-Expectancy, Cornell Studies of Satisfactions, and Need-Fulfillment. Certain implications and conclusions relevant to Air Force job satisfaction/retention research were derived, a general model of satisfaction/tenure for further inquiry was developed, and various recommendations regarding a long-range systematic research program were offered. (76 pp.)

298 **Espeland, L.R., & Walker, G.S. An experimental CMI system on the PDP 11/20. AFHRL-TR-73-57, AD-771 671. Lowry AFB, CO: Technical Training Division, December 1973. Project 1121. NTIS.** A computer managed instructional system is under development to investigate a computer managed learning environment for Air Force technical training using the PDP 11/20 mini-computer. Computer software and hardware interfaces were developed for the PDP 11/20 configuration of 24K core memory with additional 128K random access disk storage operating under the disk operating system. Hardware interfaces were developed for student key-readers, and interactive graphic terminal, a test form reader, and a computer controlled slide projector. The CMI system also incorporates the manufacturer's hardware such as the CRT terminal, the card reader, and the line printer. A series of key-reader devices, capable of reading data from a coded key, will identify the user and his location to the CMI system. The key-reader system is used to monitor the utilization of instructional materials and media devices not directly controlled by the computer. Computer software was developed to operate all of the hardware. A series of short lessons was prepared to show how an instructional course could be managed using a simple adaptive model with pretests, lesson options based on student characteristics, course tests, and feedback for the student or instructor. (6 pp.)

299 **Watson, W.J. The similarity of job types reported from two independent analyses of occupational data. AFHRL-TR-73-58, AD-776 777. Lackland AFB, TX: Occupational Research Division, February 1974. Project 7734. NTIS.** Occupational analysts using Comprehensive Occupational Data Analysis Programs (CODAP) make subjective decisions at various stages in their analysis of an occupation. The possibility exists that two different analysts could reach different conclusions in analyzing an occupation, and thereby provide divergent guidance to management. Two analysts, working independently, performed job typing using CODAP on occupational data collected by a single administration of a job inventory. Each analyst selected the same size sample, at random but without any cases common, from the total survey. The job types identified by each analyst were compared to determine whether they were significantly different in any respect. Superficial differences appeared between the results of the two analyses, but were largely resolved when job types reported by the first analyst were compared not only on a one-to-one basis with job types reported by the second analyst, but also with combinations of job types reported on the second occasion. The contents of this report are highly technical and will be of primary interest to persons working in the field of occupational analysis, both in terms of content and application of techniques. (57 pp.)

300 **Miller, R.E. Optimal assignment of Air Force pilots. AFHRL-TR-73-59, AD-781 035. Lackland AFB, TX: Personnel Research Division, February 1974. Project 7719. NTIS.** This study addresses the problem, posed by Tactical Air Command, of whether a pilot on completion of undergraduate pilot training can be optimally assigned to a particular type of aircraft or mission. The problem was approached by using peer ranks to identify pilots of above average competence in each of three specialties. Using only these pilots as subjects, a multiple discriminant analysis was performed to yield a system for identifying a unique assignment for each pilot. The system uses ten test scores and

training grades to classify a new pilot as optimally assignable to a transport, fighter, or reconnaissance aircraft or mission. The peer ranking was found to be predictable, and pilots actually assigned in accordance with their optimal assignments were shown to be better pilots, as measured by the peer ranking, than pilots not optimally assigned. (22 pp.)

301 **Stevens, C.C. Long term effects of drug use on general mental ability. AFHRL-TR-73-60, AD-775 722. Lackland AFB, TX: Personnel Research Division, December 1973. Project 7719, Contract F41609-72-C-0035, Technology Incorporated. NTIS.** The purpose of this study was to determine if there was significant long-term decrement in general mental ability as a result of drug use. For a sample of known drug users, at least one control subject for each user had been matched as closely as possible to the user by the Air Force on AQE general aptitude index, age at enlistment, year of enlistment and home of record. Scores were obtained from the subjects' high schools by the contractor on general mental ability tests administered during their high school careers. These scores were converted to a common form to allow ready comparison. Distributions were made of the number of times the subject used a given drug versus deciles of performance on the high school test score, length of use versus performance deciles, and number of times versus performance deciles within length-of-use categories. The control subjects were maintained in the use category of their matching drug users and similar distributions were made. These distributions were made for each of seven drug categories. In addition, a similar distribution was made of the number of drugs used by the subject versus performance deciles and of the total number of years any drug was used versus performance deciles. A matrix of intercorrelations was developed for all meaningful variables available in the drug user sample. The results of the study seem to indicate an overall intelligence decrement in the drug user sample, but no significant correlation was observed between duration, quantity or frequency of drug use and change in mental ability. (89 pp.)

302 **Nauta, F., & Pierce, M.B. United States Air Force training line simulator. AFHRL-TR-73-61, AD-774 572. Lackland AFB, TX: Manpower and Personnel Systems Division, December 1973. Project 6323, Contract F41609-70-C-0047, Decision Systems Associates, Inc. NTIS.** This report describes the technical aspects and potential applications of a computer-based model simulating the flow of airmen through basic training and entry-level technical training. For a more detailed description on the use of the Training Line Simulator, refer to AFHRL-TR-72-69, *the Airman Training Line Simulator*. This report gives an extensive description of input control cards and files necessary for an application of the Airman Training Line Simulator Model. The objective of this Training Line Simulator is to assess the impacts of alternative recruit classification and training policies under a wide variety of assumptions regarding the quality of recruits and entry-level training parameters. Parameters accommodated by the model include mandatory course prerequisities, attrition and setback rates, class schedules and quotas, and a host of individual airman attributes. The model evaluates the impacts of training parameter changes by determining the maximum percent fills of training quotas, the size of the waiting lines for technical training courses, student-instructor ratios and the numbers of setbacks, attritions and unassigned basic training graduates.

The Training Line Simulator is an entity simulation model with imbedded optimizations to achieve optimal fill of training quotas. The model employs an asynchronous as opposed to incremental projection methodology to achieve execution efficiencies. (49 pp.)

303 **Vitola, B.M., Mullins, C.J., Williams, J.D., & Michelson, A.E. Preliminary evaluation of the effectiveness of Air Force advertising. AFHRL-TR-73-62, AD-775 049. Lackland AFB, TX: Personnel Research Division, January 1974. Project 7719. NTIS.** The Airman Enlistment Questionnaire was administered to a sample of non prior-service enlistees, 1,667 males and 300 females. Analysis of the responses shows (1) educational opportunity is the strongest motivator for enlisting in the Air Force, (2) there is an indication that Air Force advertising should make different appeals to men and women, and (3) Air Force radio programs are not reaching a large number of the desired population. Relationships between these and other variables will be examined in a more comprehensive study involving approximately 12,000 subjects. (47 pp.)

304 **Boyd, K.N., & Jones, H.H. An analysis of factors related to desertion among FY 1968 and FY 1969 Army accessions. AFHRL-TR-73-63, AD-772 731. Alexandria, VA: Manpower Development Division, January 1973. Project 4499, Contract F41609-72-C-0038, Human Resources Research Organization (HumRRO). NTIS.** Desertion among Army accessions who entered the service at a time when entrance requirements were less restrictive for some personnel was investigated. Several personal and demographic factors were found to distinguish deserters from non-deserters. Implications for personnel selection and management are discussed on the basis of anticipated desertion rates for those factors reflecting backgrounds prior to service entry. (51 pp.)

305 **Beusse, W.E. Analysis of survey findings concerning the USAFI high school GED program. AFHRL-TR-73-64, AD-772 680. Alexandria, VA: Manpower Development Division, June 1973. Project 4499. NTIS.** This study provides information concerning the training of GED participation and its effect upon GED attainment, the degree of encouragement received and initiative demonstrated by the serviceman, where and how the serviceman heard about the GED program, participation in preparatory courses and their effect upon GED attainment, the knowledge the serviceman has about his success, conversion of GED test results into official state issued high school equivalency certificates and the reasons why individuals do not participate in the program. (33 pp.)

306 **Beusse, W.E. In-service and post-service benefits of GED program participation. AFHRL-TR-73-65, AD-773 110. Alexandria, VA: Manpower Development Division, December 1972. Project 4499. NTIS.** This study analyzes the benefits which accrue to servicemen who participate in and pass the GED equivalency tests. Achievement of GED equivalency was found to result in tangible benefits for the individual, both while in the service and in civilian life. GED recipients attained higher pay grades than those who did not receive equivalency certification. In civilian life, GED recipients were more likely to be employed in higher paying, more prestigious occupations. Also, GED holders had higher mean weekly earnings than non-high school graduates without a GED. Receipt of an official state certificate was found to increase the level of benefits which the individual received in civilian life. (34 pp.)

307 **Nadel, A.B. Attitudes of youth toward military service: selected data from four surveys, May 1971 to November 1972. AFHRL-TR-73-66, AD-778 111. Alexandria, VA: Manpower Development Division, June 1973. Project 4499. NTIS.** Selected data tabulations were extracted from a HumRRO Consulting Report summarizing the results of three national surveys of attitudes of youth toward military service. Data from the fourth survey were added to complete the two year series of surveys so far available. The period covered included the two years of 1971–1972, with field surveys accomplished by Gilbert Youth Surveys Inc., and data analysis by HumRRO. The present report selected data from various tabulations, converted these data into graphic form, with certain few exceptions, and presented the data in a format believed useful to manpower management. (89 pp.)

308 **Lohmann, D.P. An examination of some behavioral correlates of Air Force undergraduate pilot training through the use of the Porter and Lawler performance/satisfaction model. AFHRL-TR-73-67, AD-775 043. Williams AFB, AZ: Flying Training Division, February 1974. Project 1123. NTIS.** The study tested the applicability of portions of the Porter and Lawler model in a cognitive training environment and to examine the relationships among some behavioral variables in Air Force Undergraduate Pilot Training. The variables analyzed were the Maslow need hierarchy, effort, abilities, role perceptions, performance, satisfaction and the propensity to leave the organization. The statistical procedures employed were multivariate regression analysis with binary variables using backward F tests, Student t tests, correlation analysis, two way analysis of variance, the Fisher r to Z transformation and the non parametric χ^2 goodness of fit test.

The findings of the research support the Porter and Lawler model at the component level, but do not support the use of the Porter and Lawler model in a cognitive training environment to explain

performance. The model's assumption that performance is a function of effort was not supported. The research findings supported a monotonically increasing relationship between effort and performance, and a monotonically decreasing relationship between effort and the will to learn. The policy recommendations derived from the research include modifications in the instructor pilot force, removal of identified irritants in training, individualization of instruction and reward structures, programs to enhance role congruity and revisions in entrant screening procedures. Further research is recommended on the behavioral aspects of undergraduate pilot training, extrapolation of the research into the operational environment and research in other learning environments using the methodology developed. (210 pp.)

309 **Fisher, A.H., Jr., & Harford, M.A. Trends in enlistment motivation: results of AFEES surveys of enlisted men from April 1971 to April 1972. AFHRL-TR-73-58, AD-778 089. Alexandria, VA: Manpower and Personnel Systems Division. September 1973. Project 4499, Contract F41609-73-C-0030, Human Resources Research Organization (HumRRO). NTIS.** A year long survey was conducted at a sample of Armed Forces Entrance and Examining Stations to ascertain enlistment motivation of individuals entering military service. During the survey period of April 1971 to April 1972 there was a decline in draft motivated enlistments with learning skill or trade and the opportunity for advanced education as the most desirable motivators. The survey also showed the importance of family, friends, recruiter on determining in which service a man enlists. (123 pp.)

310 **McGoff, R.M., & Harding, F.D. A report on literacy training programs in the armed forces. AFHRL-TR-73-69, AD-781 366. Alexandria, VA: Manpower and Personnel Systems Division. April 1974. Project 4499, Contract F41609-71-C-0031, International Training Consultants, Inc. NTIS.** The purpose of the study was to describe the status of literacy training programs in the military services during the summer of 1971 and to develop suggestions for more effective training. Data was obtained through questionnaires, interviews, record search, and observation. The report showed wide diversity in methods and effectiveness of the various programs. The inclusion of procedures for follow-up evaluation was suggested. (52 pp.)

311 **Waller, E.A. Young men and military service: condensation of volume V, youth in transition. AFHRL-TR-73-70, AD-777 913. Alexandria, VA: Manpower and Personnel Systems Division. January 1974. Project 4499. NTIS.** Condensation of a report documenting a study to discover what factors influence young men to enlist in the military service as opposed to taking jobs or continuing education. The study covers a span of four years, 1966–1970, in the lives of 2,213 young men, beginning in the tenth grade and ending one year after high school. The major finding of the study was that there is no single military type. Enlistees are not characterized by any particular profile of background, ability or personality. (58 pp.)

312 **McCombs, B.L., Marco, R.A., Sprouls, M.W., Eschenbrenner, A.J., & Reid, G.B. Media adjunct programming: an individualized media-managed approach to academic pilot training. AFHRL-TR-73-71(I), AD-775 723. Williams AFB, AZ: Flying Training Division, January 1974. Project 1123, Contract F41609-72-C-0015, McDonnell Douglas Astronautics Company – East. NTIS.** Media adjunct programming (MAP) techniques for presenting individualized, self-paced instruction were compared to traditional instructor-classroom (TIC) techniques in an undergraduate pilot Weather course. The MAP group completed the course in significantly less time than the TIC group, representing a 29% time savings. In addition, MAP students performed equally as well on the posttest and retention test, had significantly lower state anxiety scores while learning the materials and reported significantly higher attitude scores toward the instructional method than TIC students. Predictions on the inverse relationship between state curiosity and state anxiety were partially supported, in that significant interactions were found between treatment conditions and flight groups. Possible factors contributing to flight group differences were discussed. (6 pp.)

313 **McCombs, B.L., Marco, R.A., Sprouls, M.W., Eschenbrenner, A.J., & Reid, G.B. Media adjunct programming: an individualized media-managed approach to academic pilot training. AFHRL-TR-73-71(II), AD-779 950. Williams AFB, AZ: Flying Training Division, March 1974. Project 1123. Contract F41609-72-C-0015, McDonnell Douglas Astronautics Company – East. NTIS.** Media Adjunct Programming (MAP) techniques for presenting individualized, self-paced instruction were compared to traditional instructor-classroom (TIC) techniques in an undergraduate pilot weather course. The MAP group completed the course in significantly less time than the TIC group, representing a 29% time savings. In addition, MAP students performed equally as well on the posttest and retention test, had significantly lower state anxiety scores while learning the materials and reported significantly higher attitude scores toward the instructional method than TIC students. Predictions on the inverse relationship between state curiosity and state anxiety were partially supported, in that significant interactions were found between treatment conditions and flight groups. Possible factors contributing to flight group differences were discussed. (66 pp.)

314 **Hill, J.W., & Eddowes, E.E. Further development of automated GAT–1 performance measures. AFHRL-TR-73-72, AD-783 240. Williams AFB, AZ: Flying Training Division, May 1974. Project 1123, Contract F41609-72-C-0012, Stanford Research Institute. NTIS.** This report describes a systematic, statistically-directed search for automated flight measurements that correlate with pilot proficiency. The approach is based on two separate experiments carried out in a GAT-1 trainer: a basic experiment (Experiment 1) with 326 measurements on each of 30 *S*s in three experience groups, and an expanded experiment (Experiment 2) with 2436 measurements on each of 30 new *S*s from the same three experience groups. Experiment 1 consisted of four different flight tasks, each about 10 minutes long, and Experiment 2 consisted of these and six additional tasks. The results of these experiments show that there is little difficulty in obtaining measurements that correlate with experience. More than 5% of the measurements of each experiment were statistically significant (0.01 level). Tables of more than 400 important measurements are given with group means and standard deviations and further cross-tabulations to show which tasks and families of measurements are best at discriminating among pilots. Three different statistical methods were used to select a set of measurements from Experiment 1 and combine them into two new canonical variables, each a linear-weighted combination of the measurements in the set, to discriminate optimally among the three groups of subjects. Applying the canonical variables to the repeated measurements of Experiment 2 allowed several deductions about the best selection procedure to be made. (80 pp.)

315 **Akman, A., & Nordhauser, F. A conceptual view of the officer procurement model (TOPOPS). AFHRL-TR-73-73, AD-A001 577. Lackland AFB, TX: Manpower and Personnel Systems Division, July 1974. Project 2077, Contract F41609-72-C-0042, System Automation Corporation. NTIS.** The Air Force officer procurement system is defined to include three stages: the Supply of officer applicants, the Production of commissioned officers, and the Training of commissioned officers for various assignments.

This report presents the conceptual design of a computer-based linear programming model of the Air Force officer procurement system called TOPOPS. The TOPOPS model is an aggregate model which simulates officer accession and training and is directed at optimizing officer procurement in terms of either minimizing cost or maximizing accession quality over a five-year time frame. Optimization is constrained by total production requirements by officer type (e.g., pilot, navigator, etc.), a number of policy restrictions, and the specific characteristics of the various commissioning sources and training programs (including attrition rates and career turnover). The report also contains a simplified mathematical description and a hypothetical sample problem. Completed data input forms and the five computer-generated reports for the sample problem are presented in the Appendix. (70 pp.)

316 **Alley, W.E. Development of a data base for AFROTC management analysis–1973 update. AFHRL-TR-73-74, AD-779 774. Lackland AFB, TX: Personnel Research Division, February 1974.**

Project 7719. NTIS. This is one of a series of reports describing the development of long-term AFROTC detachment effectiveness criteria and the relationships between the criteria and characteristics of the host college or university. Normative data are presented for selected criteria obtained from a seven year longitudinal study of detachment graduates entering active duty in 1963-64. The criteria included various measures of gross production, training success, aptitude level, career retention and cost effectiveness.

Criterion stability across time was determined by comparing the present data with similar measures obtained in an earlier study. Multiple regression techniques were used to analyze relationships between the criteria and a comprehensive set of institutional variables. Implications of findings for evaluating both current detachments and proposed detachment sites were discussed. (28 pp.)

317 **Christal, R.E. The United States Air Force occupational research project. AFHRL-TR-73-75, AD-774 574. Lackland AFB, TX: Occupational Research Division, January 1974. Project 7734. NTIS.** This paper describes a significant segment of the Air Force's occupational research project. It was originally presented at a U. S. Navy sponsored symposium on the state-of-the-art in occupational research and development. The first part of the paper describes how and why the Air Force uses the job inventory approach for collecting, analyzing, and reporting information describing the work performed by its personnel. This is followed by a brief description of the *C*omprehensive *O*ccupational *D*ata *C*omputer *P*rogram system (CODAP), a major product of the Air Force's occupational research project which is now being used by all U.S. Military Services and the U.S. Coast Guard. Finally, the last section describes applications of job survey information to problems in managing the personnel system. The applications section had to be restricted because of time and space limitations. It is limited primarily to one stream of research which combines information on task and job difficulty levels with data describing individual jobs. This report should be of interest to all individuals who participate in the management of the Air Force personnel system as well as to individuals who conduct occupational research.

Since this was an informal presentation, normal citation practices were not followed. A reference and credits section is included in the back of the paper. An appendix has been included which presents abbreviated descriptions of major CODAP programs. (66 pp.)

318 **Akman, A., Nordhauser, F., & Roach, J.F. A technical description of the officer procurement model (TOPOPS). AFHRL-TR-73-76, AD-A000 052. Lackland AFB, TX: Manpower and Personnel Systems Division, July 1974. Project 2077, Contract F41609-72-C-0042, System Automation Corporation. NTIS.** This technical report presents a more comprehensive mathematical formulation of the TOPOPS model than is contained in an earlier report, AFHRL-TR-73-73, *"A Conceptual View of the Officer Procurement Model (TOPOPS)."* TOPOPS is an aggregate-level, computer-based model of the Air Force officer procurement system developed to operate on the UNIVAC 1108 system. It is designed to simulate officer accession and training and achieve optimal solutions in terms of either cost minimization or accession quality maximization over a five-year procurement period.

The technical description specifies the objective functions and constraints in symbolic terms. The constraints are categorized as quality distribution constraints, program budget constraints, supply constraints, requirements constraints, policy constraints, and operating constraints. A hypothetical sample problem for minimizing cost is presented and the results are discussed. The problem is also subjected to sensitivity analysis which examines the impact of various policies on cost and accession quality. The computer-generated reports are included in the Appendix. (112 pp.)

319 **Williams, R.B. A new method for long range forecasting of F type PCS moves of airmen. AFHRL-TR-74-1, AD-781 034. Lackland AFB, TX: Manpower and Personnel Systems Division, February 1974. Project 2077. NTIS.** This report describes a new regression forecasting model and

associated operational methodology for the prediction of the annual Air Force requirement of airman F type PCS moves. The results of a five year test are presented as an evaluation of predictive effectiveness of the model. Recommendation was made to implement the new model and methodology to improve the accuracy of the Air Force PCS budget and as a basis for further model development and testing. (16 pp.)

320 **Williams, R.B. Regression prediction of airman E type PCS moves. AFHRL-TR-74-2, AD-781 036. Lackland AFB, TX: Manpower and Personnel Systems Division, February 1974. Project 2077. NTIS.** This report describes a new regression forecasting model and associated operational methodology for the prediction of the annual Air Force requirement of airman E type PCS moves. The results of a four year test are presented as an evaluation of predictive effectiveness of the model. Recommendation was made to implement the new model and methodology to improve the accuracy of the Air Force PCS budget and as a basis for further model development and testing. (16 pp.)

321 **Judd, W.A., O'Neill, H.F., Jr., & Spelt, P.F. Individual differences and learner control I: program development and investigation of control over mnemonics in computer-assisted instruction. AFHRL-TR-74-3, AD-783 844. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-73-C-0032, The University of Texas at Austin. NTIS.** The reported research was designed to investigate the impact of learner control on performance and anxiety in a computer-assisted instruction task. The research was divided into three phases. Of these three phases, only Phases I and II are reported in this document. The first phase entailed the development of a two-hour computer-assisted instruction program on the identification of edible plants. The instruction was run on an IBM 1500 instructional system. The second phase was experimentation to determine the effectiveness of learner control. Four groups were used in the experimental design. The first group (Treatment Present) always received a presumably facilitating treatment (mnemonic devices relating plant names to their critical features) while the second group (Treatment Absent) never received this facilitating treatment. These two groups served as control groups. The third and fourth groups were given learner control over access to the mnemonics but differed in the extensiveness of instructions received on the utilization of learner control. Responses to a state anxiety measure, learner control requests for mnemonics, and errors committed on segment and final tests were the dependent variables. Measures of individual differences were taken in the areas of task specific memory, Locus of Control, and Achievement via Independence. Subjects were 162 University of Texas at Austin undergraduate student volunteers who were paid for their participation. A comparison between the results of the TP and TA control groups showed that the presentation of mnemonic devices did not have the hypothesized general facilitating effect. Consequently, providing access to mnemonics via learner control did not have the hypothesized effect of reducing state anxiety or producing significant increase in performance above that of the TA group. The results of the observed relationships between the individual difference variables and learner control were complex; however, there was sufficient indication that these variables significantly interact with the use of learner control given a generally facilitating treatment being placed under learner control. Also, the intended development of well designed instructionally effective materials apparently reduced the impact of the individual difference variables. (120 pp.)

322 **McGrevy, D.F., & Valentine, L.D., Jr. Validation of two aircrew psychomotor tests. AFHRL-TR-74-4, AD-777 830. Lackland AFB, TX: Personnel Research Division, January 1974. Project 7719. NTIS.** This study documents the initial validation of two psychomotor tests developed by the Air Force Human Resources Laboratory. The tests, known as Two-Hand Coordination and Complex Coordination, bear the names of two devices used in aircrew selection in World War II, but the new tests do not closely resemble the old. The new tests use equipment which takes advantage of solid-state electronics and a mini-computer. These tests were validated on a sample of 121 student officers scheduled for pilot training. Criteria were graduation from pilot training and attrition by reason of flying deficiency. Multiple regression analyses supported the conclusion that the two

psychomotor tests together make a significant contribution to prediction of graduation in the context of the Air Force Officer Qualifying Test. Correlation data suggested that Complex Coordination is the more effective of the psychomotor tests when taken singly. A second validation study, using a similarly defined sample of 92 subjects, was focused only on Complex Coordination. Scores on this test contributed significantly to the prediction of graduation in the context of the Air Force Officer Qualifying Test. In the same context, Complex Coordination contributed significantly to prediction of a criterion category containing flying deficiency eliminees and self initiated eliminees. It is concluded that the psychomotor tests, especially Complex Coordination, are effective in predicting performance in undergraduate pilot training. It is recommended that an operational version of the tests and equipment be developed and used in a large scale validation study. (18 pp.)

323 **Siegel, A.I., Federman, P.J., & Sellman, W.S. A survey of student measurement and course evaluation procedures within the Air Training Command. AFHRL-TR-74-5, AD-786 041. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-71-C-0025, Applied Psychological Services, Inc. NTIS.** The methods, procedures, and results of an interview survey into reactions of user personnel to the Air Force Instructional System Development (ISD) system are reported. Training evaluation, student measurement, and training manager/instructor personnel were interviewed. All groups regarded the ISD procedures favorably, but some problems associated with the ISD procedures were identified. Recommendations for ISD program improvement are presented. The results of an interview survey of the Air Training Command to clarify issues relating to training evaluation and student measurement are reported. The survey was also concerned with a general assessment of the use and application of the Instructional System Development technique. A total of 139 training evaluation, student measurement and training manager/instructor personnel were interviewed. Generally favorable attitudes were reported regarding the use and application of the ISD system, the student measurement techniques, and the course review techniques. Problem areas were identified and specific recommendations for improvement are presented. (114 pp.)

324 **Carpenter, J.B. Sensitivity of group job descriptions to possible inaccuracies in individual job descriptions. AFHRL-TR-74-6, AD-778 839. Lackland AFB, TX: Occupational Research Division, March 1974. Project 7734. NTIS.** The study was designed to determine the relative impact of dichotomized task performance data compared to percent time-spent estimates for those members performing each task on the group job descriptions determined through application of the Comprehensive set of Occupational Data Analysis Programs (CODAP). Using groups identified by a routine application of the CODAP system, the percent members performing vector was found to correlate in the mid to high 90's with the percent time spent by total group vector or group job description. These findings suggest that in groups of five or more individuals, dichotomized task performance data, which has previously been shown to have high reliability and validity, is the most critical component in the resultant group job description. Further, possible time-spent inaccuracies in individual job descriptions would not be expected to cause major changes in the group job description since its unique contribution accounts for effectively less than 10% of the total variance. These results are consistent across different sized groups of varying homogeneity. This report will be of interest only to those agencies engaged in occupational data analyses employing the CODAP system. (10 pp.)

325 **McFarland, B.P. A comparison of task difficulty ratings made by nurses and medical service corpsmen. AFHRL-TR-74-7, AD-778 840. Lackland AFB, TX: Occupational Research Division, March 1974. Project 7734. NTIS.** The purpose of this study was to develop and compare task difficulty measures for Nurses and Medical Service Corpsmen. This is one of a series of reports concerning the role of the Nurse and Medical Service Corpsman in the Air Force's health care delivery system. A sample of 135 Nurses and 133 Medical Service Corpsmen completed difficulty ratings on tasks included in previously administered job inventories. The reliability of the ratings were analyzed and correlation between the two groups of ratings evaluated. The correlation between the two groups

was extremely high, suggesting that direct comparisons between difficulty of jobs performed by Medical Service Corpsmen and Nurses could be made without fear of bias as a function of raters. (26 pp.)

326 **Wood, M.E., & Gerlach, V.S. Transfer from audiovisual pretraining to a continuous perceptual motor task. AFHRL-TR-74-8, AD-778 078. Williams AFB, AZ: Flying Training Division, March 1974. Project 1138. NTIS.** A technique was developed for providing transfer-of-training from a form of audiovisual pretraining to an instrument flight task. The continuous flight task was broken into discrete "categories of flight." Each category combined an instrument configuration with a return-to-criterion aircraft control response. Three methods of sequencing categories during pretraining were compared: (1) one group was pretrained by presenting categories in a natural task sequence, (2) a second group was pretrained on categories presented in random order; while (3) a baseline group received no category pretraining. Significant positive transfer was found for both the sequenced and random forms of pretraining relative to the baseline group. Transfer percentages ranged from seven to 48% throughout transfer practice. (29 pp.)

327 **Raben, C.S., Wood, M.T., Klimoski, R.J., & Hakel, M.D. Social reinforcement: a review of the literature. AFHRL-TR-74-9(I), AD-A001 118. Lowry AFB, CO: Technical Training Division, August 1974. Project 1121, Contract F41609-72-C-0044, Ohio State University. NTIS.** This review summarizes major studies and theoretical positions within the incentive motivation field in order to present an integrated picture of past and present research. Special emphasis is placed on delineating social reinforcement variables in an attempt to explicate their relative importance within the context of social reinforcement theory; however, little emphasis is placed on strategies which have investigated different combinations of these variables. The review concludes with a summary of social reinforcement concepts and research. (64 pp.)

328 **Klimoski, R.J., Raben, C.S., Haccoun, R.R., & Gilmore, D. An annotated bibliography on social reinforcement: evaluative abstracts of research and theory. AFHRL-TR-74-9(II), AD-A001 119. Lowry AFB, CO: Technical Training Division, August 1974. Project 1121, Contract F41609-72-C-0044, Ohio State University. NTIS.** This paper is an annotated bibliography of studies dealing with social reinforcement in diverse psychological and educational contexts. The research reviewed covers the period from 1964 to 1972 and individual studies are classified according to classes of variables which have been found to moderate the effectiveness of social reinforcement. All total, 234 studies representing a wealth of theoretical and empirical evidence, are summarized. (270 pp.)

329 **Kingsley, E.H., & Stelzer, J. A theoretical basis for individualized instruction. AFHRL-TR-74-10, AD-786 040. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-73-C-0020, Human Resources Research Organization (HumRRO). NTIS.** This research was designed to formulate a theoretical basis for a model of individualized instruction. The theory is semi-axiomatic in nature so that the definitions and assumptions used are stated explicitly. Set theory and symbolic logic are the conceptual tools used. The model includes theories of subject-matter structure and student state description. These are related by an overall instructional model. A main result shows how subject-matter structure constrains student state transitions through a subject matter. An application of the subject-matter theory is made to an existing Air Force course. A number of open problems are given whose further investigation would help make the model a more practical instructional tool. (122 pp.)

330 **Sullivan, D.J., Smith, E.A., & Filinger, R.H. A survey of the present state-of-the-art in learning center operations. AFHRL-TR-74-11, AD-776 776. Lowry AFB, CO: Technical Training Division, February 1974. Project 1121, Contract F41609-72-C-0033, Hughes Aircraft Company. NTIS.** This report summarizes a survey of selected military, industrial, government, and academic learning

centers. Documentation of 28 learning center programs is recorded and illustrated. This documentation includes primary characteristics and a description of operational procedures and experience at the learning centers. Learning centers deemed effective were (1) designed to meet a clearly defined and existing instructional need (and typically included student performance requirements), (2) administered under a unified control of courseware content and production quality, and (3) largely developed and produced their own courseware to meet their specific needs. In general, student time savings and increased training effectiveness were reported. Learning centers can provide cost-effective instruction. (112 pp.)

331 **Joyce, R.P., & Chenzoff, A.P. Improving job performance aids through condensation, dual-level presentation, promotion of learning, and entry by malfunction symptoms. AFHRL-TR-74-12, AD-781 757. Wright-Patterson AFB, OH: Advanced Systems Division, March 1974. Project 1710, Contract F33615-73-C-4033, Applied Science Associates, Inc. NTIS.** This report describes the research effort that attempted to simplify and condense the presentation of Job Performance Aid (JPA) data. It also describes a method of presenting technical data to both experienced and inexperienced personnel in one JPA format. Such factors as text limitations, illustration criteria, layout restrictions, and physical size of the manuals were found to contribute to the excessive bulk of the JPAs. Controls were developed for each of the influencing factors. Dual-level presentation of technical data was also studied. This portion of the study identified the types of information required, and not required by experienced technicians. The original JPA sample was reformatted, incorporating both condensation principles and dual-level presentation factors. The application of condensation principles resulted in a decrease from 104 pages in the original 4″ x 8″ size to 18 pages in the larger 8 1/4″ x 10 3/4″ size, and information was provided for both experienced and inexperienced personnel. The sample JPAs were then evaluated by novice and experienced mechanics. The condensed, dual-level JPAs provided proper information to both experienced and inexperienced personnel and were well received. A third aspect of this study concerned troubleshooting. A review of the goals of fully proceduralized troubleshooting was accomplished, and possible changes in goals were suggested. A possible way to enter a troubleshooting procedure utilizing known failure symptoms was developed and discussed. (84 pp.)

332 **Schumacher, S.P., Swezey, R.W., Pearlstein, R.B., & Valverde, H.H. Guidelines for abstracting technical literature on instructional system development. AFHRL-TR-74-13, AD-777 757. Wright-Patterson AFB, OH: Advanced Systems Division, February 1974. Project 7907, Contract F33615-72-C-1884, Applied Science Associates, Inc. NTIS.** Guidelines are presented for preparing abstracts of technical literature on instructional systems development (ISD). Although specifically developed for abstracting information during the preparation of a technical data file on ISD, the guidelines are sufficiently general to apply to other areas in which abstracts of technical literature are desired. For abstracting purposes, the literature was divided into two categories: (1) Type I and (2) Type II documents. The first category includes opinion articles, methodological developments, evaluative summaries, literature reviews, and bibliographies. The second category includes statistical sampling studies, correlational research, and research studies in which variables are manipulated. Both types of abstract are prepared on the same general form. A sample of the abstract form and examples of a completed Type I and Type II abstract are included. The sample form permits the most important characteristics of a document to be synthesized to facilitate the computerization of the technical data file. (89 pp.)

333 **Schumacher, S.P., Pearlstein, R.B., & Martin, P.W. A comprehensive key word index and bibliography on instructional system development. AFHRL-TR-74-14, AD-777 192. Wright-Patterson AFB, OH: Advanced Systems Division, February 1974. Project 7907, Contract F33615-72-C-1884, Applied Science Associates, Inc. NTIS.** This report provides a bibliographic listing of the 2,692 items

selected and abstracted for a basic file of technical information on instructional system development. Both reports of pertinent original research as well as summarizing and discursive articles are included. The items date as far back as 1953 and represent a subset of articles within the general topic selected for special relevance. In addition, a comprehensive index according to over 600 key words is provided to assist the user in finding items of immediate interest. (243 pp.)

334 **Schumacher, S.P., & Wiltman, S. A compendium of research and development needs on instructional system development. AFHRL-TR-74-15, AD-777 196. Wright-Patterson AFB, OH: Advanced Systems Division, February 1974. Project 7907, Contract F33615-72-C-1884, Applied Science Associates, Inc. NTIS.** This report provides a comprehensive listing of specific needs for research on instructional systems development, as identified and noted by the authors of 2,692 related articles. The articles from which the needs were taken had been selected and abstracted for a basic file of technical information on instructional system development. Because the items date as far back as 1953 some, of course, may no longer be relevant but no attempt was made to reflect degree of current relevance in this listing. The needs are categorized and listed by principal system development activities and, in turn, by more specific subsidiary concerns. (52 pp.)

335 **Miller, R.E. Development and standardization of the Air Force Officer Qualifying Test Form M. AFHRL-TR-74-16, AD-778 837. Lackland AFB, TX: Personnel Research Division, March 1974. Project 7719. NTIS.** Air Force Officer Qualifying Test Form M was constructed as a replacement for AFOQT Form L in Fiscal Year 1974. The new form serves the same purposes as its predecessor and possesses basically the same characteristics. It yields Pilot, Navigator-Technical, Officer Quality, Verbal, and Quantitative composite scores. Three sets of conversion tables are provided for examinees at the various educational levels where the test is administered. Standardization was accomplished by equipercentile conversion to composites of Project TALENT tests from a previous form which was administered to Air Force Academy candidates, and thence to the new form in a stratified sample of basic airmen. This strategy permits the new AFOQT scores to be related to Academy candidates and to 12th grade males in the original Project TALENT study. Because recent operational data suggest that the AFOQT is becoming too difficult, a correction which was used prior to AFOQT-64 was reinstated. The correction is for the unusually high academic aptitude of the Academy candidate group, especially with respect to the quantitative domain. The correction primarily affects the Navigator-Technical, Officer Quality, and Quantitative composites and should lead to somewhat increased qualification rates without fundamentally changing the AFOQT normative base. (14 pp.)

336 **Fallentine, B.C., Harris, L.R., Maginnis, E.B., & Hanson, A.L. Advanced development work resulting in inventory management (IM) individualized instruction materials. AFHRL-TR-74-17, AD-777 833. Lowry AFB, CO: Technical Training Division, February 1974. Project 1193, Contract F33615-71-C-1813, System Development Corp. NTIS.** This report describes a study to develop prototype individualized instructional materials and identify potential problems for the Inventory Management Course as part of the Advanced Instructional System. Typical course segments and a final block of instruction were selected and instructional materials were developed for these segments. The materials were tried in the classroom by the contractor on an individual basis and then with a group of students. The materials were revised as required. The materials were then tried out on several classes by the Air Force. All students attained all learning objectives. A mean student time savings of 55% was achieved during the AF trials. No major problems were encountered. Student attitudes toward the materials and methods were highly favorable. (188 pp.)

337 **Gott, C.D. Development of the weighted airman screening system for the air reserve forces. AFHRL-TR-74-18, AD-781 747. Lackland AFB, TX: Computational Sciences Division, March 1974. Project 6323. NTIS.** In July 1973, a policy-capturing study was conducted at the Computational Sciences Division of the Air Force Human Resources Laboratory to support the development of a

Weighted Airman Screening System (WASS) for the Air Reserve Forces (ARF). A group of ARF personnel consisting of six officers and six noncommissioned officers convened to form an experimental promotion policy board. Each board member was tasked with ranking for promotion a representative sample of ARF enlisted men. The sample consisted of E-4 airmen eligible for promotion to E-5 and E-6 airmen eligible for promotion to E-7. The rankings were performed with respect to each airman's promotability on the basis of the following six promotion selection factors: (1) Specialty Knowledge Test (SKT), (2) Promotion Fitness Examination (PFE), (3) Time-in-service (TIS), (4) Time-in-grade (TIG), (5) Total good years (TGY) for retirement, and (6) Performance Evaluation Report (PER).

The rankings provided by the promotion board were first used in a regression analysis to develop an individual policy equation for each board member. Next, hierarchical grouping procedures were applied to determine which members employed similar promotion judgments. Three basic overall policies were apparent. The weights derived for each selection factor reflected the relative importance placed upon the factors by each overall policy. The first policy, representing eight out of the twelve board members, placed dominant weight on the SKT selection factor. The second policy, reflecting the judgment of two other members, likewise showed a dominance of one factor, in this case the PFE factor. The third policy, derived from the remaining two members, placed primary emphasis on SKT and PFE with lesser weights on PER and TGY. The weights for TIS and TIG were for practical purposes almost negligible for all three basic equations. Finally, procedures were outlined to aid ARF personnel managers in evaluating the various alternatives and in selecting an operational system.

In total, this report describes the experimental promotion policy board, the reserve airman sample, the promotion selection factors, the procedures followed, the analyses performed, and results in the development of WASS. (22 pp.)

338 **Christal, R.E. Proceedings of 19. Division Military Psychology symposium: collecting, analyzing, and reporting information describing jobs and occupations. AFHRL-TR-74-19, AD-774 575. Lackland AFB, TX: Occupational Research Division, February 1974. Project 7734. NTIS.** A symposium was conducted by Division 19. Military Psychology, of the American Psychological Association at the 77th Annual Convention of APA in Washington, D.C., 31 Aug –.4 Sep 69. The four presentations dealt with job analysis in the Canadian Forces, the military occupational data bank and job analysis, job analysis in the US Training and Employment Service (UST&ES), and collecting, analyzing and reporting information describing jobs in the United States Air Force. (92 pp.)

339 **Pieper, W.J., Pinkus, A.L., & Thomas, D.L. Computer generated troubleshooting trees: application and tryout. AFHRL-TR-74-20(I), AD-A004 634. Wright-Patterson AFB, OH: Advanced Systems Division, November 1974. Project ILIR, Contract F33615-72-C-1682, Applied Science Associates, Inc. NTIS.** This report describes the results of a project to refine and test a procedure for developing troubleshooting trees by computer. In an earlier project conducted by NASA, a computer program and data preparation procedures were developed. However, the program and procedures were not fully tested. In this project, the procedures and program were refined, adapted, and tested. They were tested by using them to develop troubleshooting trees for a moderately complex electronic system. The troubleshooting trees were then evaluated by inserting faults into the equipment and using the trees to isolate the faults. Although the trees did not lead to isolation of 100% of the faults, the results did indicate that development of troubleshooting trees by computer is feasible. However, further refinements of the process are required before it can be used operationally. Additional information on the development and use of the computer program is given in AFHRL-TR-74-20(II). (96 pp.)

340 **Pieper, W.J., & Pinkus, A.L. Computer generated troubleshooting trees: the program. AFHRL-TR-74-20(II), AD-785 139. Wright-Patterson AFB, OH: Advanced Systems Division, July**

1974. Project ILIR, Contract F33615-72-C-1682, Applied Science Associates, Inc. NTIS. This volume describes the development, use, and tryout of a computer program to prepare troubleshooting trees by computer. The program inputs information on the system data flow, component reliabilities, and costs of available tests. An iterative process is then used to select the most efficient sequence of tests to isolate all possible faults. This is accomplished by computing an index of information gained per unit cost (IGUC) for each test. The test with the highest IGUC is selected as the first test in the tree. The IGUCs are then recomputed for the remaining tests and the test with the highest IGUC is added as the next step in the tree. The process is continued until a tree is developed which will isolate all faults in the system. The procedures and program were tested by using them to develop troubleshooting trees for a 300 component electronic system. The troubleshooting trees developed were tested by using them to isolate faults inserted into the equipment. Although the trees did not lead to isolation of 100% of the faults, the results did indicate that computer development of troubleshooting trees by computer is feasible. However, further refinements of the process are required before it can be used operationally. (96 pp.)

341 **Saunders, J.R., Vitola, B.M., & Mullins, C.J. Correlates of barbiturate use. AFHRL-TR-74-21, AD-783 846. Lackland AFB, TX: Personnel Research Division, March 1974. Project 7719. NTIS.** A sample of 448 self-admitted pre-service barbiturate users was compared with a control sample of airmen with no known record of drug abuse. Within the sample of barbiturate users, several variables were examined to see if they were associated with degree of barbiturate use. The barbiturate sample differs significantly from the control sample in that barbiturate users are disproportionately represented in the North-Northeast and Far West-Pacific Coast enlistment areas, they more often indicate no religious preference, and they enlist at a younger age. Degree of barbiturate use is negatively associated with aptitude, educational level, and with measures of success in the Air Force. However, degree of barbiturate use is positively associated with the use of other drugs. (22 pp.)

342 **Earles, J.A., Mullins, C.J., & Vitola, B.M. Variables related to amphetamine use. AFHRL-TR-74-22, AD-783 236. Lackland AFB, TX: Personnel Research Division, March 1974. Project 7719. NTIS.** A sample of 985 self-admitted amphetamine users was compared with a sample of airman who had no known record of drug abuse. Results of this study indicate that there is a very strong likelihood for amphetamine users to abuse other drugs. There are relationships between amphetamine use and geographic area of enlistment, religious preference, aptitude scores, educational level, and age at enlistment. Amphetamine use is also related to the likelihood of getting an undesirable discharge and to lower APR ratings. (22 pp.)

343 **Fisher, A.H., Jr., Harford, M.R., & DiSario, M.R. Enrollment potential for college based military officer training programs: a comparison of results conducted in May 1972 and May 1973. AFHRL-TR-74-23, AD-779 010. Alexandria, VA: Manpower and Personnel Systems Division, January 1974. Project 4499, Contract F41609-73-C-0030, Human Resources Research Organization (HumRRO). NTIS.** The interest of college-bound high school seniors in applying for college-based military officer training programs was assessed. Comparisons were made between surveys conducted in 1972 and 1973. It was found that the Air Force and the Navy ROTC scholarship programs were the most popular with the youth surveyed. Higher likelihood of applying was found among youths from low income families. Travel, adventure and the opportunity for technical and professional training were strong motivators in applying for officer training programs. Prominent among the specific reasons for affiliating with military programs were: being able to attend the college of one's choice; getting tuition paid; and the term of obligated service. There was very little awareness of officer compensation and the service sponsorship of the various programs offered. (102 pp.)

344 **Pritchard, R.D., Von Bergen, C., Jr., & DeLeo, P.J. Incentive motivation techniques evaluation in Air Force technical training. AFHRL-TR-74-24, AD-A005 302. Lowry AFB, CO: Technical**

Training Division, November 1974. Project 1121, Contract F41609-71-C-0026, Purdue Research Foundation. NTIS. Incentive management or incentive motivation techniques essentially offer valued outcomes for high performance. Such systems have had positive effects on performance in such diverse situations as classrooms, mental institutions, and industry. The purpose of this report is to describe an 18-month research project designed to evaluate the effectiveness of incentive motivation techniques in Air Force technical training. The research was conducted at Chanute Air Force Base near Rantoul, Illinois. The first phase of the research utilized a variety of techniques to identify incentives, as well as to determine their attractiveness and feasibility. These incentives so identified were used in the second phase of the research which made these incentives contingent on performance in two of the resident training courses at the base. The first system gave incentives based on actual performance in the courses. The second utilized a system whereby an attempt was made to give the incentives on the basis of effort. The third was identical to the second except that additional, financially based incentives were offered. The results indicated that while secondary performance measures such as amount of remedial instruction, frequency of probations, and frequency of course failures decreased under the incentive program, the primary performance measures of scores on exams and speed of course completion did not generally show much improvement. Yet, from a cost-effectiveness viewpoint, even the relatively small (i.e., 8 percent) increase in speed of course completion was meaningful. Attitudes generally improved or stayed the same under the program. It was concluded that one of the incentives systems utilized in this research was cost-effective for Air Force technical training. Suggestions for improving incentive systems were given. (294 pp.)

345 **McGrevy, D.F., Knouse, S.B., & Thompson, R.A. Relationships among an individual intelligence test and two Air Force screening and selection tests. AFHRL-TR-74-25, AD-781 033. Lackland AFB, TX: Personnel Research Division, March 1974. Project 7719. NTIS.** With the implementation of the All Volunteer Force concept, the Air Force must insure that the objectively measurable range of ability in its manpower pool is being utilized. This is especially true for minority groups who have been categorized and channeled into military career areas based upon their performance on two selection tests: the Armed Forces Qualification Test (AFQT) and the Airman Qualifying Examination (AQE). To investigate the relationship of the AFQT and AQE to the general mental ability of different racial groups of airmen, a sample of 100 black and 100 white Air Force basic trainees was administered an established test of general mental ability, the Wechsler Adult Intelligence Scale (WAIS). The Verbal, Performance, and Full Scale IQ scores of the white and black airmen were compared to their AFQT scores and their four AQE Aptitude Indexes. Significant differences between black and white airmen were found on the AFQT, the four AQE Aptitude Indexes, and the three WAIS IQs. Regression analyses demonstrated most differences to be interaction effects between race and Air Force test scores. Implications for further research into Air Force airmen selection tests were discussed. (18 pp.)

346 **Miller, R.B. A method for determining task strategies. AFHRL-TR-74-26, AD-783 847. Wright-Patterson AFB, OH: Advanced Systems Division, May 1974. Project 7907, Contract F33615-72-C-1014, American Institutes for Research. NTIS.** This study is an extension of task analysis methodology. The concept of strategic principles or task strategies implicit in the job activities of highly proficient performers is examined with the intent of improving training. The goal is to identify or invent such strategies, as appropriate, and then proceed with training encouraging use of them. A set of 25 information processing functions is described along with examples of strategic principles and training implications. Certain other strategic principles not readily interpretable in information processing terms are presented also. An analytic procedure for determining and/or devising strategies is provided and suggestions on the teaching and learning of strategies are summarized. (50 pp.)

347 **Dailey, K.A. Compressed speech: potential application for Air Force technical training. AFHRL-TR-74-27, AD-781 754. Lowry AFB, CO: Technical Training Division, April 1974. Project 1121. NTIS.** Time-compressed speech (also denoted as compressed speech, speeded speech, or accelerated speech) is an extension of the normal recording procedure for reproducing the spoken word. Compressed speech can be used to achieve dramatic reductions in listening time without significant loss in comprehension. The implications of such temporal reductions in the educational setting are that time savings can be used functionally to review, repeat or extend the material which was originally presented. This report includes a definition and description of compressed speech techniques as they have been evolved, a discussion of certain methodological issues engendered by the current literature, a summary of selected literature (grouped by system topics), and a discussion of current and potential studies, possible applications, and general recommendations concerning the impact of compressed speech on technical training in the Air Force. (20 pp.)

348 **Siegel, A.I., Federman, P.J., & Burkett, J.R. Increasing and evaluating the readability of Air Force written materials. AFHRL-TR-74-28, AD-786 820. Lowry AFB, CO: Technical Training Division, August 1974. Project 1121, Contract F41609-72-C-0011, Applied Psychological Services, Inc. NTIS.** This report describes how to apply techniques that have been used in measuring the readability/comprehensibility and reading level of textual materials. Instructions are provided, in a step-by-step fashion, for determining the reading level of written material and for presenting subject matter material through methods other than prose. In addition, procedures for simplifying written material are presented. Experimental procedures, to be used in determining the effectiveness of written material, are described. Finally, multisensory presentation of Air Force training material is examined. (90 pp.)

349 **Williams, A.R., Jr., Siegel, A.I., & Burkett, J.R. Readability of textual materials—a survey of the literature. AFHRL-TR-74-29, AD-785 140. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-72-C-0011, Applied Psychological Services, Inc. NTIS.** The literature relating to methods of measuring the readability/comprehensibility of textual materials is reviewed and analyzed. Various formulas for calculating readability are presented and placed in historical perspective. The general status of research into the development of readability indices is discussed. (70 pp.)

350 **Judd, W.A., O'Neil, H.F., Jr., & Spelt, P.F. Individual differences and learner control II: investigation of control over pictorial mediators in computer-assisted instruction. AFHRL-TR-74-30, AD-783 845. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-73-C-0032, The University of Texas at Austin. NTIS.** The reported research was designed to investigate the impact of learner control on performance and anxiety in a computer-assisted instruction task. The research was divided into three phases. The results of Phases I and II are reported in Technical Report AFHRL-TR-74-3, "Individual Differences and Learner Control I: Program Development and Investigation of Control over Mnemonics in Computer-Assisted Instruction," (Judd, O'Neil, and Spelt, 1974). The results of Phase III are reported in this document.

The learning task for Phase III was the identification of edible plants and their critical features and edible parts. Experimental hypotheses centered on the affective advantages of learner control, personality variables which influence the use of learner control, and the instructional effectiveness of pictorial mediators under learner control. Three experimental groups were used. A treatment present (TP) group always received a facilitating treatment (pictorial mediators). A treatment absent (TA) group never received the facilitating treatment and the learner control (LC) group had control over the availability of the facilitating treatment.

For performance, there was a significant difference between the TP and TA groups with TP having the highest mean performance. This proved that the facilitating treatment was an effective

learning variable to be placed under learner control. Performance of the LC group excelled that of the TA group and did not significantly differ from that of the TP group. The presumed affective advantage of learner control was not shown. Of the two personality measures used, Locus of Control (IE) Scale and Achievement via Independence (Ai) Scale, only the Ai scale was found to predict individual differences in learner control behavior; however, the best predictor of learner control behavior and performance was a task specific measure developed for this project. (70 pp.)

351 **Tetmeyer, D.C. Estimating and controlling manpower requirements for new systems: a concept and approach. AFHRL-TR-74-31, AD-778 838. Wright-Patterson AFB, OH: Advanced Systems Division, April 1974, Project 1124. NTIS.** The Air Force faces qualitative, quantitative and budgetary limitations on the number of personnel by AFSC that can be provided to maintain new weapon systems. A systems concept is proposed for manpower prediction and control during the development cycle, using automated data systems and simulation techniques. A plan is presented for a feasibility demonstration during validation phase on the A-X Tactical Aircraft. (40 pp.)

352 **Pritchard, R.D., Leonard, D.W., Von Bergen, C.W., Jr., & Kirk, R.J. The effects of varying schedules of incentive delivery on technical training. AFHRL-TR-74-32, AD-A001 117. Lowry AFB, CO: Technical Training Division, September 1974. Project 1121, Contract F41609-73-C-0022, Institute for Organizational Behavior Research. NTIS.** The research reported here was initiated and designed to assess the impact of various schedules of incentive delivery (schedules of reinforcement) on performance and attitudes in an Air Force-related setting. Civilian subjects matching the characteristics of Air Force trainees were hired to work for four weeks, one week under each of four schedules of reinforcement: salary, fixed ratio, variable ratio, and variable ratio-variable amount. The results indicated that the salary schedule resulted in the lowest performance and attitudes. Performance was best under the variable ratio-variable amount schedule, while attitudes were best under the fixed ratio schedule. It was concluded that instituting a fixed or variable ratio-variable amount schedule of incentive delivery would be a highly cost-effective procedure in computer managed Air Force training. (102 pp.)

353 **Meyer, R.P., Laveson, J.I., Weissman, N.S., & Eddowes, E.E. Behavioral taxonomy of undergraduate pilot training tasks and skills: executive summary. AFHRL-TR-74-33(I), AD-A008 771. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-73-C-0040, Design Plus. NTIS.** This report summarizes the development and application of a behavioral taxonomy of undergraduate pilot training (UPT) tasks and skills. The taxonomy specifies the fundamental flying abilities which comprise the training objectives of UPT. Its purpose is to provide a broadly applicable conception of UPT that obviates the need to continually study each specific training task or aircraft to determine the requirements for training hardware and software in research on and the development of optimized flying training programs. (26 pp.)

354 **Meyer, R.P., Laveson, J.I., Weissman, N.S., & Eddowes, E.E. Behavioral taxonomy of undergraduate pilot training tasks and skills: surface tasks analysis, taxonomy structure, classification rules and validation plan. AFHRL-TR-74-33(II), AD-A000 053. Williams AFB, AZ: Flying Training Division, July 1974. Project 1123, Contract F41609-73-C-0040, Design Plus. NTIS.** The objective is to analyze and specify the fundamental flying abilities which comprise the training objectives of Undergraduate Pilot Training (UPT). The results of this analysis will be used as a foundation for structuring research on and recommendations for improvements in Air Force flying training programs. The Phase I effort focused on a review of literature relevant to the development of a taxonomy of flying tasks and skills, a surface analysis of fundamental flying tasks, generation of a basic taxonomic structure and classification rules and planning for an evaluation of the taxonomy. Reports of the results of previous taxonomic studies were reviewed to avoid duplication of effort in the present research. Analyses of relevant flying tasks were reviewed and used in producing task

analysis. A concept of the pilot-aircraft system operation was evolved and subsequently applied in configuring both the surface analysis and the taxonomy structure. Examination of previous task and skill taxonomies failed to provide a useable basis for the present effort. The surface task analysis was developed on the basis of a breakdown of task elements according to the cue, mental action and motor action involved. The flying tasks analyzed were found to fall into three categories: fundamental transitions, composite transitions and continuous transitions. The surface task analysis was organized so the more complex flying maneuvers could be accommodated by a sequence of two or more of the three categories of task types identified. A cubic taxonomic structure was developed with cue, motor action and mental action dimensions. A set of classification rules was provided for locating any flying training task in a specific "pigeon hole" within the taxonomic structure. A procedure for evaluating the validity of the taxonomic system was established for use during Phase II of this program. (102 pp.)

355 **Meyer, R.P., Laveson, J.I., Weissman, N.S., & Eddowes, E.E. Behavioral taxonomy of undergraduate pilot training tasks and skills: taxonomy refinement, validation and operations. AFHRL-TR-74-33(III), AD-A008 201. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-73-C-0040, Design Plus. NTIS.** The objective is to analyze and specify the fundamental flying abilities which comprise the training objectives of Undergraduate Pilot Training (UPT). The results of this study will be used as a basis for structuring research on and recommendations for improvements in Air Force flying training programs. The flight training maneuvers of UPT were analyzed according to a breakdown of task elements into the cues, mental actions and motor actions required to accomplish them. Flying tasks analyzed were found to fall into three categories: fundamental transitions, composite transitions and continuous transitions. A set of classification rules were developed to locate any flying training task element in a specific "pigeon hole" within a taxonomic cubic structure with a cue, motor actions and mental actions serving respectively as the vertical, horizontal and depth axes of the cube.

The taxonomic cubic structure was refined and subsequently validated by having flying training personnel who had not participated in development of the taxonomy's classification rules and procedures use them to classify several sample tasks. The validation test resulted in an overall agreement of 82% among the test raters. This outcome was interpreted as indicating that the taxonomy could be used for the purposes for which it was developed, that is, to describe an orderly relationship between the flying tasks analyzed and the skills required in their execution.

During this phase of the study, 22 additional flight tasks were analyzed supplementing the 14 tasks analyzed previously. All the tasks analyzed were classified and the resulting skill data were further categorized according to a hierarchy of taxonomic rules. The taxonomic hierarchy was adapted to a matrix system of information categorization which was found to provide for simplified data retrieval. (216 pp.)

356 **Meyer, R.P., Laveson, J.I., Weissman, N.S., & Eddowes, E.E. Behavioral taxonomy of undergraduate pilot training tasks and skills: guidelines and examples for taxonomy application in flying training research. AFHRL-TR-74-33(IV), AD-A008 897. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-73-C-0040, Design Plus. NTIS.** This report presents the results of the third phase of a research program to develop a behavioral taxonomy of undergraduate pilot training (UPT) tasks and skills. The Phase III effort consisted of the continued development of surface analyses to include instrument flight maneuvers, the classification of the resulting surface analysis information and its integration within the taxonomic data system, an analysis of future UPT objectives in terms of present and future flying training requirements and the development of four applications of the taxonomic data system to flying training research problems. The illustrative examples dealt with skill comparisons among different tasks, the determination of skill difficulty within and between tasks, developing standard training tasks and generating new training tasks to teach specific flying skills. (190 pp.)

357 **Samers, B.N., Dunham, A.D., & Nordhauser, F. The development of a methodology for estimating the cost of Air Force on-the-job training. AFHRL-TR-74-34, AD-785 141. Lackland AFB, TX: Manpower and Personnel Systems Division, July 1974. Project 2077, Contract F41609-72-C-0048, Cooper and Co. NTIS.** The Air Force uses a standardized costing methodology for resident technical training schools (TTS); no comparable methodology exists for computing the cost of on-the-job training (OJT). This study evaluates three alternative survey methodologies and a number of cost models for estimating the cost of OJT for airmen training in the Administrative Specialty (702X0) from the 1-level (helper) to the 3-level (semi-skilled). The final costing methodology selected for use in the next phase of this research effort can easily be adapted to other Air Force specialties and skill levels. The quality of OJT and TTS graduates is compared according to several criteria, and the evidence indicates that neither type of training is superior to the other for the Administrative Specialty. The cost per graduate of OJT for this specialty was estimated to be significantly below the cost of TTS. However, it is important to consider other factors in addition to cost prior to drawing any inferences concerning the optimal OJT/TTS mix. The effect of these factors is discussed at length in this report. (67 pp.)

358 **Vitola, B.M., Mullins, C.J., & Brokaw, L.D. Quality of the all-volunter Air Force–1973. AFHRL-TR-74-35, AD-781 755. Lackland AFB, TX: Personnel Research Division, April 1974. Project 7719. NTIS.** Characteristics of all-volunteer force enlistees were compared to characteristics of 1970 through 1972 enlistees. Analyses of the four years of data result in the following conclusions: (a) compared to the 1971 and 1972 accessions, there has been an increase in average aptitudes of the 1973 accessions in the Mechanical and Electronics areas. There has been a decrease in the Administrative and General areas. Air Force quality is improving but did not reach the quality level demonstrated by 1970 first-term accessions, (b) there has been an appreciable loss of accessions who have completed education beyond the high school level. This loss is accompanied by a year-by-year downward shift of percentages of first-term airmen scoring at the higher centile levels of the four aptitude indexes of the AQE, (c) the aptitude level patterns of South-Southwest (areas 3 and 4) enlistees were not consistently low, compared to the other areas, as they were in 1970 through 1972, (d) the aptitude levels of Black enlistees in 1973 are higher than they were in 1970 through 1972. This phenomenon obtained by geographic area of enlistment and total sample, and (e) other than a possible need to offer incentives to high-aptitude people, especially in the General and Electronics areas, Air Force operational capability does not appear to be significantly affected by the absence of the draft. (16 pp.)

359 **Sticht, T.G., Beck, L.J., Hauke, R.N., Kleiman, G.M., & James, J.H. Auding and reading: a developmental model. AFHRL-TR-74-36, AD-786 042. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-73-C-0025, Human Resources Research Organization (HumRRO). NTIS.** This report describes an auding/reading model that accounts for the development of receptive oracy and literacy skills. The model presents a classification scheme for the development of reading and auding skills which considers basic adaptive processes, languaging precursors, and languaging processes. Four hypotheses consistent with the model were derived: (1) the ability to comprehend language by auding will surpass ability to comprehend language by reading during early school years, until reading skill is acquired–following which time the ability to comprehend by auding and reading will become equal; (2) performance on measures of ability to comprehend language by auding will be predictive of performance on measures of ability to comprehend language by reading, after reading skill is acquired; (3) performance on measures of reading rate and auding rate will be comparable, after reading decoding skill has been developed: and (4) training in comprehending by auding will transfer to reading, after reading skill is acquired. An extensive literature review of empirical data bearing on the model supported each of the four hypotheses. It was concluded that reading is based upon, and utilizes the same conceptual base and languaging competencies as used in auding, and that reading skills can be improved through training in

languaging using oracy skills (auding and speaking). Other conclusions and implications of the model are provided, including suggestions for improving literacy training and directions for future research. (116 pp.)

360 **Fisher, A.H., Jr., & DiSario, M.R. Attitudes of youth toward military service in a zero-draft environment: results of a national survey conducted in November 1972. AFHRL-TR-74-37, AD-781 370. Alexandria, VA: Manpower and Personnel Systems Division, February 1974. Project 4499, Contract F41609-73-C-0030, Human Resources Research Organization (HumRRO). NTIS.** This study analyzed the 1972 results of a continuing DoD national survey aimed at studying the enlistment motivation and attitudes toward military service of American youth. A total of 1,924 male youths, aged 16 to 21 years, were interviewed during a period of low draft calls, reduced troop levels in Vietnam, and increased service pay allowances. Topics covered included their willingness to enlist in the active service under a zero-draft condition, to volunteer for active service as officers, and their views on enlistment incentives, service preference, and career objectives. Results varied according to age and educational status, with high school students showing a higher enlistment potential than college students and males not in school. Fully paid college educations provided the greatest enlistment incentive, especially to the 16 and 17-year olds. Bonus options appealed especially to non-whites. Pay and secure employment were indorsed as the two most important life goals. (108 pp.)

361 **Fisher, A.H., Jr., & Rigg, L.S. Career potential of enrollees in PLC, ROC, and AVROC: a comparison of surveys conducted in May 1972 and May 1973. AFHRL-TR-74-38, AD-781 371. Alexandria, VA: Manpower and Personnel Systems Division, November 1973. Project 4499, Contract F41609-73-C-0030, Human Resources Research Organization (HumRRO). NTIS.** Research into the short-range and long-range career intentions of PLC, ROC and AVROC enrollees in 1973 and 1972 showed that most enrollees intended to stay in their programs. From 30 percent to 40 percent indicated they intended to pursue a military career, while about 50 percent were undecided. Knowledge of financial benefits did not influence career intentions; those planning to leave the service were as likely to overestimate pay and benefits as were the career-oriented personnel.

Reasons given for entering the program were similar in both years, with "Military career opportunities," "Travel, adventure, and new experiences," and "Service to your country" the most popular reasons. (58 pp.)

362 **Fisher, A.H., Jr., Orend, R.J., & Rigg, L.S. Career potential among ROTC enrollees: a comparison of 1972 and 1973 survey results. AFHRL-TR-74-39, AD-781 374. Alexandria, VA: Manpower and Personnel Systems Division, November 1973. Project 4499, Contract F41609-73-C-0030, Human Resources Research Organization (HumRRO). NTIS.** Research into the career intentions of Army, Navy and Air Force ROTC cadets showed that a majority were willing to stay and continue into the advanced program, even without financial aid. The proportion for Army enrollees was much lower than for Navy or Air Force enrollees. Almost half of all advanced cadets were undecided about staying on active duty for more than one tour of duty, with Army enrollees the least likely and Air Force enrollees the most likely to remain.

"Military career opportunities" and the chance for "travel, adventure, and new experiences" were the most commonly cited reasons for entering ROTC. Navy cadets also indorsed the "opportunity for further academic education."

A majority of Army and Air Force scholarship holders, and less than half the Navy scholarship enrollees, indicated they would have entered ROTC without a scholarship. Over 60 percent in all services indicated they would have entered ROTC without a subsistence allowance. (124 pp.)

363 **Tuttle, T.C., Brockhaus, W.L., & Hazel, J.T. Development and feasibility test of a method to study location assignment preferences of airmen. AFHRL-TR-74-40, AD-781 041. Lackland AFB,**

TX: Occupational Research Division, April 1974. Project 7734. NTIS. This study evaluated the feasibility of an approach to investigate geographic location preferences of airmen. Two preference ratings were obtained from 509 basic airmen for each of 150 Air Force locations, one based on the location name, then unnamed, based on a 22 variable environmental profile description. Findings indicated the approach was feasible; that considerable variance was revealed across both individuals and locations; that the base selected variables could explain a considerable proportion of the rating variance through regression analysis. Further study of location preferences of experienced personnel is recommended. (16 pp.)

364 **Mullins, C.J., Vitola, B.M., & Abellera, J.W. Users of cannabis only. AFHRL-TR-74-41, AD-A002 145. Lackland AFB, TX: Personnel Research Division, April 1974. Project 7719. NTIS.** Subjects who have used only cannabis were compared with those who have used cannabis along with other drugs, and with a control sample on whom no drug-using information was available. Results indicate that cannabis-only users are more effective than users of other drugs, and that even cannabis-only users compare unfavorably with the control subjects in certain metrics which appear to require motivation as an important component. It is suggested that this may be evidence for the "amotivational syndrome" reported in the literature. (14 pp.)

365 **Foley, W.L. High-speed rotating mirror system for wide-angle image projection. AFHRL-TR-74-42, AD-A001 629. Wright-Patterson AFB, OH: Advanced Systems Division, June 1974. Project 6114. NTIS.** The design and fabrication of visual display systems with a wide field-of-view and high resolution, as is required for pilot training simulators, is a formidable problem. Individual displays must be carefully fabricated and mosaicked together so the resulting system maintains continuity and resolution over the total display field. While such systems have been successfully developed, the optical components can be large and expensive, and alignment is a formidable problem where several channels are required. Methods were investigated for wide angle deflection of a laser beam at rates compatible with standard video processing. The effort consisted of investigation and design of a magnetic suspension and rotation device for achieving scan rates in excess of 3,000 revolutions per second. Two design ("Q" coil and differential pickup) approaches were investigated and measurements were made of rotational rates and acceleration versus input drive power. Stability was investigated under short term conditions for different rotor configurations, and special measures were undertaken to minimize drift of the supported body. One of the designs, namely the differential pickup type, appears worthy of further investigation and testing. (52 pp.)

366 **Hagin, W.V., & Smith, J.F. Advanced simulation in undergraduate pilot training (ASUPT) facility utilization plan. AFHRL-TR-74-43, AD-786 411. Williams AFB, AZ: Flying Training Division, June 1974. Project 1123. NTIS.** The capabilities of a flight simulation research facility located at Williams AFB, AZ are described. Research philosophy to be applied is discussed. Long range and short range objectives are identified. A time phased plan for long range research accomplishment is described. In addition, some examples of near term research efforts which will be conducted during periods when the total system is not available are described in some detail. These projects address immediate simulator users's needs. (38 pp.)

367 **Rust, S.K., Smith, J.F., & Woodruff, R.R. Syllabus and syllabus development techniques used in evaluating the A/F37A/T-4G flight simulator. AFHRL-TR-74-44, AD-786 412. Williams AFB, AZ: Flying Training Division, June 1974. Project 1123. NTIS.** This report describes the A/F37A/T-4G (T-4G) simulator syllabus developed by the Flying Training Division of the Air Force Human Resources Laboratory, to demonstrate the effectiveness of a limited visual, limited motion flight simulator in T-37 undergraduate pilot training. This report: (1) describes the syllabus development procedures employed; (2) clarifies the resulting syllabus content and format; and (3) provides a guide for development of future special purpose syllabi. (38 pp.)

368 **Garza, A.T., & Carpenter, J.B. Comparative job attributes of airmen and civil service personnel having similar job types. AFHRL-TR-74-45, AD-786 407. Lackland AFB, TX: Occupational Research Division, May 1974. Project 7734. NTIS.** Military and civil service personnel having similar job types and from comparable accounting and finance career ladders were compared on several attributes. The data reveal certain distinct differences between the two populations with the magnitude of the differences being highly variable as functions of specific job types considered. Generally, civilians perform a larger number of tasks, the tasks and overall jobs they perform are more difficult, they find their jobs more interesting, and feel that their jobs make greater use of their talents and training. In view of these differences in attributes and the potentially higher cost of military personnel, conversion of certain military positions to civilian positions to meet operational needs appears feasible. Unique attributes of civilian and military personnel also point out the necessity for further research into their causes and consequent effects in such areas as promotion, skill upgrading, career progression, worker attitudes, and retention. The need for investigation appears more critical for the airmen population because of their expressed job dissatisfaction, particularly those performing disbursement accounting functions where simple highly repetitive tasks tend to predominate. (18 pp.)

369 **Lewis, W.E., Willow, J.D., Brock, G.R., Lonigro, J.K., Jr., Eschenbrenner, A.J., Jr., & Hanson, A.L. Precision measuring equipment (PME) individualized instruction. AFHRL-TR-74-46, AD-A001 239. Lowry AFB, CO: Technical Training Division, August 1974. Project 1193, Contract F33615-71-C-1846, McDonnell Douglas Astronautics Company–East. NTIS.** Self-paced programmed and audio-visual (AV) instructional materials covering portions of Air Force Course, 3ABR32430-2, Precision Measuring Equipment (PME) Specialist, were developed, administered, and evaluated as means of assessing the feasibility of individualizing the PME course as part of the Air Force Advanced Instructional System (AIS). The materials for a 90-hour block of instruction, entitled Waveform Analysis, included printed and AV media and covered complex cognitive and performance skills. For this block, there was a 31% reduction in mean training time with all trainees achieving all criterion objectives. Trainees achieved 99% of the performance objectives on the first attempt. The mean written test score was 80.1% (the passing score was 70%). Three of the 35 trainees required remediation because of low written test scores. Trainee attitudes toward the materials and system as measured by an attitude scale were positive. The materials for three smaller course segments, 6, 6, and 9 hours, respectively, consisted of printed adjunct programs and covered cognitive skills. The reduction in training times were 60%, 70%, and 61%, respectively. The written test scores were 83%, 96%, and 99%. The reduction in training time coupled with trainee achievement supports the feasibility of individualizing the PME course as part of the AIS. The projected cost savings for 1,025 students of reduced course length resulting from the conversion of the 90-hour block into self-paced instruction is in excess of $40,000.00/yr. Such projected savings argue strongly for the cost-effectiveness of individualizing the entire PME course and other similar technical training courses. (64 pp.)

370 **Siegel, A.I., Lambert, J.V., & Burkett, J.R. Techniques for making written material more readable/comprehensible. AFHRL-TR-74-47, AD-786 849. Lowry AFB, CO: Technical Training Division, August 1974. Project 1121, Contract F41609-73-C-0018, Applied Psychological Services, Inc. NTIS.** This technical memorandum presents an outline of how to apply psycholinguistic and intellective concepts to enhance the readability and comprehensibility of written materials. Guidelines for making the reader's task easier are provided, and some readability measurement procedures are also discussed. (28 pp.)

371 **Hansen, D.N., Johnson, B.F., Fagan, R.L., Tam, P., & Dick, W. Computer-based adaptive testing models for the Air Force technical training environment phase I: development of a computerized measurement system for Air Force technical training. AFHRL-TR-74-48, AD-785 142. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-73-C-0013, Florida State University. NTIS.** Adaptive testing is viewed as a theoretical framework with associated computerized

techniques combining to offer solutions to the growing measurement challenges of individualized technical training. It is characterized by three subprocesses: (a) appropriate test selection and entry; (b) tailored presentation of test items; (c) sensitive scoring, diagnosis, interpretation, and reporting. In the context of Air Force technical training, five benefits of adaptive testing are seen: (a) saving instructional and test time; (b) improving reliability and validity of test decisions; (c) optimizing entry and movement within a required learning hierarchy; (d) assisting training management through refined data specification, collection, and dissemination; and (e) minimizing remediation time. Related literature is reviewed and synthesized into the three areas of subprocesses listed above, including review papers, test selection and student entry, tailored testing with descriptions of eight models, adaptive testing for hierarchical structures, and scoring, diagnosis, interpretation, and reporting. Three proposed studies, based on prior work done in two Air Force technical courses, are described in a design for validation of adaptive testing. These are a flexilevel test study, a hierarchical learning task adaptive test study, and a criterion zone decision study. The paper concludes with discussion and recommendations. (86 pp.)

372 **Siegel, A.I., & Burkett, J.R. Application of structure-of-intellect and psycholinguistic concepts to reading comprehensibility measurement. AFHRL-TR-74-49, AD-A001 573. Lowry AFB, CO: Technical Training Division, September 1974. Project 1121, Contract F41609-73-C-0018, Applied Psychological Services, Inc. NTIS.** Concepts and considerations relative to the measurement of textual readability/comprehensibility through psycholinguistics and through intellective variables are presented. Two experiments, each investigating the potential of each of these areas for readability/comprehensibility measurement, are described and the results of these experiments are given. The results supported a contention favoring the potential of psycholinguistics and intellective concepts for readability/comprehensibility measurement. Concepts are presented for automating the measurements described. (164 pp.)

373 **Logan, R., O'Neil, H.F., Jr., Judd, W.A., & Harmon, E.G. Technical literature review concerning management information systems. AFHRL-TR-74-50, AD-781 749. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, May 1974. Project DALS, Contract F41609-73-C-0019, The University of Texas at Austin. NTIS.** The primary objective of the literature review was to obtain sources of information relevant to the feasibility and utility of an on-line data management system in support of the management and planning effort in the research and development environment of the Air Force Human Resources Laboratory. The formal documentation of the technical literature reviewed resulted in an annotated bibliography of 112 references.

The intended audience for the bibliography was middle- and upper-level management personnel. Documents were selected that would familiarize such personnel with the context and interrelationships of the many aspects of management information systems (MIS); that is, with how analysis, design, operation, evaluation, and user considerations affect management information systems. (44 pp.)

374 **O'Neil, H.F., Jr., Walker, M.E., & Judd, W.A. Feasibility and utility of an on-line information communication system in a research and development management and planning environment. AFHRL-TR-74-51, AD-785 143. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, July 1974. Project DALS, Contract F41609-73-C-0019, The University of Texas at Austin. NTIS.** The objectives of this study consisted of three stipulated tasks. These tasks were: (1) to conduct and document a thorough, comprehensive review of existing literature which addresses itself to implementation and evaluation of on-line data management systems; (2a) to analyze methods currently in existence within the Air Force Human Resources Laboratory (AFHRL) for processing management and planning information; and (2b) to analyze the information needs of a designated subset within the AFHRL; (3a) to develop implementation and evaluation strategies; (3b) to demonstrate and evaluate the feasibility of the strategies and techniques developed. This interim report will discuss tasks (1) and (2) and will provide baseline data for task (3). (64 pp.)

375 **Fitzgerald, J.A. The value of an air combat maneuvering range to the Tactical Air Command. AFHRL-TR-74-52, AD-786 850. Williams AFB, AZ: Flying Training Division, June 1974. Project 1123. NTIS.** In this briefing to the COR Group, the author takes the position that the Tactical Air Command needs an instrumented range for training in air-to-air combat-Air Combat Maneuvering Range (ACMR) as early as possible, and makes a case for a coordinated plan of utilization for the Simulator for Air-to-Air Combat (SAAC) and an ACMR. It is asserted that the complementary capabilities of the two systems can make important contributions to tactical fighter training, tactics development, and simulator development. (10 pp.)

376 **Wiley, L.N. Across-time prediction of the performance of airman administrators and mechanics. AFHRL-TR-74-53, AD-786 409. Lackland AFB, TX: Occupational Research Division, July 1974. Project 7734. NTIS.** It was found that supervisors' ratings of Administration Specialists' and Aircraft Mechanics' job performance were predictable across time. Airmen in duty AFSCs 702X0/70490 and 431X1/43190 were rated on overall job performance and 65 traits. After two years for mechanics and three years for administrators, the available airmen were located and rerated. More than half were rated by two supervisors on each occasion, which permitted testing the agreement between raters for airmen at the same skill levels. At least 16% of the Time 2 performance variance was predictable from trait ratings, with multiple Rs from .40 to .47. The first overall performance ratings made less prediction than did the 65 trait ratings taken as a whole. The results helped to support earlier findings, on samples which included these airmen, that the traits important for the performance of mechanics differed somewhat from the traits important for administrators; also, that skill levels within ladders differ in their trait requirements. The traits used were statements of consistent work behaviors, as distinguished from vague generalizations. (28 pp.)

377 **McFarland, B.P. Potential uses of occupational analysis data by Air Force management engineering teams. AFHRL-TR-74-54, AD-A000 047. Lackland AFB, TX: Occupational Research Division, July 1974. Project 7734. NTIS.** The purpose of this study was to identify and evaluate areas in which Air Force Management Engineering Teams (MET) might benefit from occupational research data. For the study occupational research data was provided as a supplemental input to the development of MET engineered manpower standards for base level Data Automation. The analysis revealed that the techniques used by MET and occupational analysis yield essentially the same information. Also a number of areas were identified in which occupational research data and techniques could be beneficially employed by MET. (14 pp.)

378 **Kauffman, D., Johnson, M., & Knight, G. The empirical derivation of equations for predicting subjective textual information. AFHRL-TR-74-55, AD-786 427. Williams AFB, AZ: Flying Training Division, July 1974. Project 1123, Contract F41609-71-C-0027, Arizona State University. NTIS.** Parameters pertaining to information processing by human beings have, in the past, been determined by learning and memory experiments with nonsense syllables, number sequences, etc. However, in the real world we are concerned with the processing of "meaningful information" not senseless texts. Therefore, the determination of *subjective* information directly from meaningful material becomes extremely important in the instruction-learning process.

This study derives an equation for predicting the *subjective* textual information contained in a text of material written in the English language. Specifically, this investigation describes, by a mathematical equation, the relationship between the *subjective* information content of written textual material and the relative number of errors committed by a learner when asked to predict, letter by letter, the content of given textual material. This relationship shows that the subjective information of a given text for a specific learner is directly proportional to the number of wrongly-guessed signs made by that learner. This is expressed mathematically by

Where: I = Information in Bits

E = Number of wrongly guessed signs

The application of Shannon's guessing procedure (1951) in this study permits the measurement of the *subjective* information of a given text for a specific learner. Unlike senseless texts, the *subjective* information of a meaningful text varies from learner to learner. Therefore, the derived equation permits the measurement of information in terms of a value that is dependent not only upon the inherent qualities of the subject matter, but also upon the internal state of the learner.

The derived equation for the English language is then compared to an equation derived by Weltner (1967) for the German language and found to be remarkably similar. (40 pp.)

379 **Archer, J.R., & Giorgia, M.J. Bibliography of the Occupational Research Division, Air Force Human Resources Laboratory (AFSC). AFHRL-TR-74-56, AD-A003 421. Lackland AFB, TX: Occupational Research Division, July 1974. Project 7734. NTIS.** This report presents an unclassified, unlimited bibliography of technical reports and other publications on research conducted by the Occupational Research Division, Air Force Human Resources Laboratory (AFHRL). The cited references cover the period July 1957 – March 1974. The reports listed in this bibliography are obtainable to qualified requestors upon request or information as to where the requested paper or report may be obtained will be provided. (34 pp.)

380 **Foley, J.P., Jr. Evaluating maintenance performance: an analysis. AFHRL-TR-74-57(I), AD-A004 761. Wright-Patterson AFB, OH: Advanced Systems Division, October 1974. Project 1710. NTIS.** Late in 1962, the writer prepared a paper entitled *Performance Testing: Testing for What is Real* (Foley, 1963). This was followed by a *Bibliography on Maintenance Personnel Performance Measurement* by Askren (1963) and work on a draft of an annotated bibliography by Porterfield in the same year. All of these efforts indicated that there was probably a lack of job realism in the formal measuring devices used to ascertain the training success and promotion potential of maintenance personnel. They also indicated that although a rather extensive technology had been developed for paper and pencil testing, no well-structured technology or guidance existed for the development and administration of job performance tests. These preliminary works and findings indicated a requirement for exploratory development concerning job performance tests for maintenance.

To avoid duplication in such an exploratory development program, the approach was to tap the wealth of existing, but scattered, sources of available hard data concerning job performance measurements, to structure these data as they applied to the measurement of ability to perform electronic maintenance tasks, to analyze them in relation to current Air Force practice and to make recommendations for the development and tryout of effective job performance measurements for Air Force electronic maintenance.

Paper and pencil testing procedures are used almost exclusively for determining which personnel are selected for training, for determining student progress while in training and for determining the promotion eligibility of personnel assigned to field maintenance units. A number of studies are cited which indicate that low correlations were obtained by comparing job task performance tests to paper and pencil theory tests and to job knowledge tests. Several studies also are cited which indicate that the traditional theory content, found in most electronic maintenance training programs, does not contribute a great deal to the ability to perform electronic maintenance tasks. A full application of the modern technology for technical training development would solve the course content problem. This technology requires a systems approach to training program development in which training objectives are based on a complete job task identification and analysis. Criterion referenced Job Task Performance Tests (JTPT) are required to determine if training objectives are achieved. However, a serious gap remains in this technology since adequate guidance is not available for the development of JTPT.

As a result of this analysis, it was recommended that comprehensive exploratory and advanced development efforts concerning Air Force maintenance should be established and funded. These programs should systematically and comprehensively identify and solve problems concerning maintenance practice in the field and problems concerning the selection and training of maintenance personnel. A necessary first effort should be to gather and study hard data on how well maintenance men can perform the key tasks of their jobs. Also, based on the results of this analysis a contractual effort was initiated to develop criterion referenced JTPT for electronic maintenance tasks. This effort was followed by an attempt to develop both graphic and video symbolic substitutes of improved empirical validity. The results of these efforts are reported in Volumes II, III, and IV of this series of documents. (38 pp.)

381 **Shriver, E.L., & Foley, J.P., Jr. Evaluating maintenance performance: the development and tryout of criterion referenced job task performance tests for electronic maintenance. AFHRL-TR-74-57(II), Part I, AD-A004 845. Wright-Patterson AFB, OH: Advanced Systems Division, September 1974. Project 1710, Contracts F33615-69-C-1232 and F33615-70-C-1695, URS/Matrix Research Co. NTIS.** The previous Volume, AFHRL-TR-74-57(I), recommended the development of criterion referenced Job Task Performance Tests (JTPT) for typical electronic maintenance activities. This Volume reports the development of a battery of such tests together with an appropriate scoring scheme for reporting the results of administering them. The development of a Test Administrator's Handbook also is described. This battery is considered to be a model for future criterion JTPT development and is intended for both formal training and field use. The battery includes separate tests for the following classes of job activities: (1) equipment checkout, (2) alignment/calibration, (3) removal/replacement, (4) soldering, (5) use of general and special test equipment, and (6) troubleshooting. The Doppler Radar, the AN/APN-147, and its computer, the AN/ASN-35, were selected as a typical electronic system. This system was used as the test bed for this model battery. The soldering and general test equipment JTPT are applicable to all electronic technicians. The other tests of the battery apply to technicians concerned with this specific doppler radar system. Each class of activity for which JTPT were developed contains its individual mix of behaviors, but it is not mutually exclusive. There are dependencies among the classes. As a result, a four level hierarchy of dependencies can be stated: (1) checkout, removal/replacement, and soldering; (2) use of general and special test equipment; (3) alignment/calibration; and (4) troubleshooting. For example, troubleshooting may include all the activities mentioned before it. Due to the diverse character of the various mixes of behaviors involved in each class of maintenance activity, a single score report of test results would be meaningless. A profile of test results therefore was developed which provides for an individual cell for each test problem. The tests are structured so that each problem produces a product. The result for each problem is reported in terms of a go, no-go score. Either the test subject produces a satisfactory **product** or he does not. Where *time* is important, he must produce the satisfactory product in a specified time. Although *process* may be valuable as a diagnostic tool, it is not considered as an appropriate factor for scoring purposes. The hierarchy of dependencies mentioned previously has implication for the order in which tests are administered as well as for diagnostics. For example, since troubleshooting includes the use of test equipment and other activities in the hierarchy, logic would dictate that administration of the tests for the sub-activities would precede the troubleshooting tests and that a test subject would not be permitted to take the troubleshooting tests until he had passed these other subtests. Due to the unavailability of a sufficient number of experienced test subjects at the time of the tryout of the JTPT battery, the tryout was not as extensive as planned. The limited tryout did indicate that the tests as developed are administratively feasible. Their continued use, no doubt, would result in further modifications and polish. The report also includes a discussion of several implementation considerations and suggestions. (112 pp.)

382 **Shriver, E.L., Hayes, J.F., & Hufhand, W.R. Evaluating maintenance performance: test administrator's manual and test subject's instructions for criterion referenced job task performance tests for electronic maintenance. AFHRL-TR-74-57(II), Part II, AD-A005 785. Wright-Patterson AFB, OH: Advanced Systems Division, January 1975. Project 1710, Contracts F33615-69-C-1232 and F33615-70-C-1695, URS/Matrix Research Co. NTIS.** The purpose of this document is to furnish a complete copy of the Test Subject's Instructions and the Test Administrator's Handbook for a battery of criterion referenced Job Task Performance Tests (JTPT) for electronic maintenance. Part I of Volume II of this series of documents, AFHRL-TR-74-57, reports and describes the development and tryout of this battery of tests. (690 pp.)

383 **Shriver, E.L., & Foley, J.P., Jr. Evaluating maintenance performance: the development of graphic symbolic substitutes for criterion referenced job task performance tests for electronic maintenance. AFHRL-TR-74-57(III), AD-A005 296. Wright-Patterson AFB, OH: Advanced Systems Division, November 1974. Project 1710, Contracts F33615-70-C-1550 and F33615-71-C-1505, URS/Matrix Research Co. NTIS.** An in-depth review of the literature reported in AFHRL-TR-74-57(I) of this series of documents strongly reiterated the fact that paper and pencil tests of job knowledge and electronic theory tests have very poor criterion-related or empirical validity with respect to the ability of electronic maintenance men for performing their job tasks. As a result, a battery of criterion referenced Job Task Performance Tests (JTPT) was developed and tried out and results were reported in AFHRL-TR-74-57(II). The battery included tests for the various job activities performed by electronic maintenance technicians such as checkout, align/adjust, remove/replace, soldering, use of general and special test equipment, and troubleshooting. Past experience with tests similar to these criterion referenced JTPT has indicated that even though criterion referenced JTPT were recognized as being superior by many training people, paper and pencil tests were substituted because they were more easily and cheaply developed and administered. The JTPT developed required the test subject to use actual equipment and they could only be administered to very small groups; in some cases, to only one subject. Graphic symbolic substitutes would probably overcome these administrative problems. *But* such substitutes must have high empirical validity. Most previous attempts to develop such tests resulted in low validity. This volume describes another attempt to develop a battery of graphic symbolic substitutes of improved validity. A review of previous attempts resulted in a hypothesis that previous attempts had weaknesses in realism that could possibly be rectified. The successful accomplishment of most maintenance tasks must follow a main line procedure or strategy. *But* this main line usually is "cluttered" with distraction and subprocedures which interfere with the accomplishment of the main line procedure or strategy. For example, when troubleshooting, the technician must usually interrupt his strategy several times to set up his test equipment and to obtain check point information. Unless he is well organized and very persistent in following his strategy, he may lose track of his strategy. Even if he stays on the main line, he may gather faulty information from his test equipment which will prevent him from finding the trouble. Based on this rationale, it was concluded that previously developed symbolic tests such as the tab test did not provide such clutter. It was hypothesized that symbolic substitute tests could be developed that would retain a large amount of realistic task "clutter" and that such tests would have higher empirical validity than previously developed symbolic tests. In this effort, a battery of symbolic tests was developed including a companion symbolic test for each of the job activities for which a criterion referenced JTPT had previously been developed. Based on two limited validations, all of the graphic symbolic tests, with the exception of the symbolic test for soldering, indicated sufficient promise to justify further consideration and refinement. All of these promising symbolic tests should be given more extensive validations using larger numbers of experienced subjects. The validation of any such symbolic tests requires the administration of a companion JTPT as a validation criterion. As a result, a validation is an expensive process in terms of equipment and experienced manpower. The troubleshooting symbolic tests require the most extensive refinement. Several suggestions are made for improving their empirical validity. (76 pp.)

384 **Shriver, E.L., Hayes, J.F., & Hufhand, W.R. Evaluating maintenance performance: a video approach to symbolic testing of electronics maintenance tasks. AFHRL-TR-74-57(IV), AD-A005 297. Wright-Patterson AFB, OH: Advanced Systems Division, July 1974. Project 1710, Contract F33615-71-C-1505, URS/Matrix Research Co. NTIS.** This volume reports an effort to use the video media as an approach for the preparation of a battery of symbolic tests that would be empirically valid substitutes for criterion referenced Job Task Performance Tests. The development and tryout of such criterion referenced tests and promising graphic symbolic substitute tests are reported in previous volumes. The graphic symbolic tests require the storage of a large amount of pictorial information which must be searched rapidly for display. At the time this video effort was started, no completely satisfactory way had been found for rapidly searching and displaying such information. In addition, some dynamic displays would have been desirable for those graphic symbolics whereas all of the original graphic pictorials are static. The anticipated results, that the video media would provide satisfactory and economical solutions to these problems, did not materialize. From a testing point of view symbolic tests place the test subject in a passive, evaluative role of watching someone else perform each task. Success, in this passive role, does not insure his success in the active role of performing the same task. Also, the development costs of the video tests proved to be very high in terms of video equipment and test development time. To obtain video materials of acceptable quality would require both quality video equipment and studio production facilities. As a result, it was recommended that video should not be further considered as a testing medium for performance analogues and that future efforts should be aimed at improving and refining graphic symbolic substitute tests. (20 pp.)

385 **Pina, M. The assignment of airmen by solving the transportation problem. AFHRL-TR-74-58, AD-786 426. Lackland AFB, TX: Manpower and Personnel Systems Division, July 1974. Project 2077. NTIS.** To help the Air Force managers understand some of the many optimization techniques, two techniques, one which directly optimizes payoff values and one which indirectly optimizes payoff values, are discussed. In discussing these optimization techniques, the policy of fill and the policy of fit are discussed since they are an important part of both techniques. The techniques for solving the transportation problem will give the Air Force manager some insight into at least two assignment policies and two optimization techniques and will pose questions which must be considered in trying to optimize assignment of Basic Military Training graduates to their Air Force Specialty Code (job). (12 pp.)

386 **Vitola, B.M., Mullins, C.J., & Weeks, J.L. Characteristics of women in the Air Force 1970 through 1973. AFHRL-TR-74-59, AD-A000 049. Lackland AFB, TX: Personnel Research Division, July 1974. Project 7719. NTIS.** The total input of WAF enlistees for 1970 through 1973 (N = 20,988) was compared with male enlistees for the same period (N = 324,935). WAF AQE-A and AQE-G scores in 1973 have dropped less than those for males relative to 1970. WAF AQE-M and AQE-E scores in 1973 were higher than they were in 1970, whereas similar scores for males have declined slightly. Educational level for males has declined in the years 1970-1973, whereas, for WAF, it has climbed somewhat. Racial mix for females is about the same as for males, but the contribution by the various recruiting areas to the total number of Black women in the Air Force varies considerably from area to area. As with males, the younger females tend to have lower aptitude scores. (18 pp.)

387 **Weeks, J.L., Mullins, C.J., & Vitola, B.M. Prediction of drug abuse by the life values questionnaire. AFHRL-TR-74-60, AD-A000 048. Lackland AFB, TX: Personnel Research Division, August 1974. Project 7719. NTIS.** Three experimental psychological tests were investigated to determine if they contributed significantly to the prediction of seven drug abuse criteria when combined with available demographic and aptitude variables. The results indicate that only one of these tests, the Life Values Questionnaire, adds significantly to prediction. Although the validities yielded by the Life Values Questionnaire for the criteria are not high, it appears that its predictive variance is fairly unique. (18 pp.)

388 **Woodruff, R.R., Smith, J.F., & Morris, R.A. Use of the T-4G simulator in USAF undergraduate pilot training (UPT), phase I. AFHRL-TR-74-61, AD-786 413. Williams AFB, AZ: Flying Training Division, July 1974. Project 1123. NTIS.** The A/F37A/T-4G, a T-37 flight training simulator with limited visual and motion capability, was evaluated to determine the extent to which its technology could be used to substitute for flying hours in the UPT T-37 syllabus. A special syllabus maximizing T-4G capabilities was used. This report describes the first phase in which six UPT students were trained in the T-4G/T-37 program. The six students completed contact training in 23.4 flying hours (a savings of 3.8 hours), and they completed instrument training in 9.7 flying hours (a savings of 11.1 hours). (40 pp.)

389 **Ward, J.H., Jr., & Haltman, H.P. Computer-based enlistment quota reservation system using the general data management system 2000. AFHRL-TR-74-62, AD-A002 146. Lackland AFB, TX: Manpower and Personnel Systems Division, August 1974. Project 2077. NTIS.** This report describes the capabilities of a computer-based quota reservation system using the general data management System 2000. The system was designed as a feasibility demonstration for Air Force Recruiting Service staff. Operational commands are described which allow a user to search the data base to locate enlistment openings for which applicants might be eligible. A user can also reserve an enlistment opening when the applicant is ready to accept a position.

Management can use commands that summarize openings and enlistments by Air Force Specialty Code, aptitude area and other categories. (28 pp.)

390 **Eddowes, E.E. A cognitive model of what is learned during flying training. AFHRL-TR-74-63, AD-A000 046. Williams AFB, AZ: Flying Training Division, July 1974. Project 1123. NTIS.** The cognitive model of what is learned during flying training presents an alternative to the familiar concept of flying skill as hand-eye coordination. The model relates the growth of pilot ability to the student's increasingly refined cognitive discriminations about his flying performances made possible by his improved familiarity with the phenomena of flight gained practicing aircraft control tasks.

As the student pilot becomes familiar with his flying tasks, he anticipates his control requirements. Consequently, his performance improves. This leads to better error discriminations, increased aircraft control effectiveness and more familiarity with the phenomena of flying, which is in turn followed by another incremental cycle. This interpretation views the acquisition of flying skill as a spiral-type expanding cognitive process rather than a linear-type perceptual motor skill refinement process. (12 pp.)

391 **Hoskins, J.A. Modified TOPCAP objective force structure model. AFHRL-TR-74-64, AD-A004 760. Lackland AFB, TX: Manpower and Personnel Systems Division, August 1974. Project 2077. NTIS.** Spiralling personnel costs, coupled with increased emphasis on management by objectives, has accentuated evaluation of personnel quality/quantity/cost tradeoffs pertinent to the development of a career force objective and enlisted force management system. A modification to one of the methodologies in the Total Objective Plan for Career Airman Personnel (TOPCAP) Computerized Management System, the Objective Force Structure Model, is proposed. The effort was prompted by a need for a method to evaluate tradeoffs between the "quality" of personnel entering the career force and the effects on the TOPCAP objective grade and force configuration. (18 pp.)

392 **Miller, G.G. Some considerations in the design and utilization of simulators for technical training. AFHRL-TR-74-65, AD-A001 630. Lowry AFB, CO: Technical Training Division, August 1974. Project 1121. NTIS.** The current technical literature, as it relates to simulators, training devices, and simulation in technical training is reviewed. Rules and principles for the cost-effective application of simulation are also included. A major finding is that fidelity can be quite low in certain procedural tasks without a decrement in performance.

Other studies indicated that some complex electronic equipment can be simulated in simple, relatively inexpensive devices without having an adverse effect on training.

In general, very few studies have been completed to validate the rules and principles of simulation that were developed over 20 years ago. (32 pp.)

393 **Stephenson, R.W., & Burkett, J.R. An action oriented review of the on-the-job training literature. AFHRL-TR-74-66, AD-A011 620. Lowry AFB, CO: Technical Training Division, December 1974. Project 1121, Contract F41609-72-C-0036, American Institutes for Research. NTIS.** The on-the-job training (OJT) literature was reviewed, and selected references were organized in terms of the following categories: literature reviews and bibliographies; handbooks and manuals; cost effectiveness; technique comparison studies; systems analysis of training; approaches to program evaluation; and military documents. In addition, a number of references were selected that are thought to contain innovative ideas that should be considered by people with responsibility for managing and evaluating OJT programs. The various ways in which these "innovations" might address current interests or problems in the Air Force OJT program are described. Specific comments are made about the possible advantages associated with each idea. Estimates are also made of the resource requirements involved if modifications to existing procedures or programs were to be implemented. (168 pp.)

394 **Hayes, J.F., & Pulliam, R. Development and evaluation of video systems for performance testing and student monitoring. AFHRL-TR-74-67, AD-786 891. Lowry AFB, CO: Technical Training Division, July 1974. Project 1121, Contract F41609-72-C-0021, URS/Matrix Research Co. NTIS.** A video performance monitoring system was developed by the URS/Matrix Company, under contract to the USAF Human Resources Laboratory (AFHRL/TT), and was evaluated experimentally in three technical training settings. Using input from 1 to 8 video cameras, the system provided a flexible combination of signal processing, direct monitor, recording and replay options including fast, slow, and stopped motion. The system design was based on hypothesized benefits or manpower savings in technical training, achieved by the remote and/or recorded monitoring of trainee performance, and the standardization of measurement criteria using recorded performance samples.

URS/Matrix designed and procured assembly of a presumed cost-optimized system, using commercially available components. The system was demonstrated in jet aircraft mechanic performance testing, in the screening of candidates for power lineman (pole climbing) training, and in the evaluation of instructor trainees. Research findings and recommendations were reported. Instructions for further use of the system were developed, and the system was delivered to AFHRL for USAF application. (210 pp.)

395 **Cooper and Company. The attractiveness of Air Force non-monetary benefits. AFHRL-TR-74-68, AD A005 299. Lackland AFB, TX: Manpower and Personnel Systems Division, July 1974. Project 2077, Contract F41609-72-C-0051, Cooper and Co. NTIS.** This study provides estimates of the valuations placed on various military non-monetary benefits by Air Force personnel and explores the relationships between these valuations and personnel retention. Empirical data were obtained using a stratified sample survey approach for 3,698 active duty personnel, which included a large amount of biographical and attitudinal data, as well as the dollar compensation that would be required for each of 15 non-monetary benefits–if eliminated–to make the respondent feel just as well off as he does now with the benefit.

Major conclusions/recommendations derived from this effort include the following (a) the Air Force should take no action to educate its present personnel in the area of non-monetary benefits–except the retirement benefit–in general (evidence indicates that increased knowledge has a negative effect on non-monetary benefit valuations); (b) the retirement benefit should be stressed and

explained in terms of its high "present value" during the first enlistment because of its positive role in personnel retention, and (c) the Air Force should consider providing cash to its present personnel in lieu of non-monetary benefits (benefit allocations which are provided by the Air Force are not necessarily the same allocations that would be chosen if Air Force members had cash). (190 pp.)

396 **Mullen, P.A., & Joyce, R.P. Demonstration of fully proceduralized job performance aids and matching training. AFHRL-TR-74-69, AD-A002 147. Wright-Patterson AFB, OH: Advanced Systems Division, August 1974. Project 1194, Contract F33615-69-C-1812, Applied Science Associates, Inc. NTIS.** Sixteen airmen with no background in electronics were given four weeks of job-oriented training and then observed as they performed maintenance while using fully proceduralized job performance aids (FPJPAs). Half of the airmen had the high aptitude usually required for training in electronics. The other half had significantly lower aptitudes. There is some evidence that most of the airmen were below average in reading ability. This effort had two purposes. One was to provide interested military and civilian personnel a preview of the maintenance performance of minimally trained airmen using FPJPAs. Another was to shake-down or debug the FPJPAs and the matching training program prior to a major experimental comparison of alternative types of technical data and training for maintenance. The airmen were observed by the experimenter and a continually changing group of interested observers as they performed 14 maintenance tasks on a Doppler Radar set (AN/APN-147) and its Computer (AN/ASN-35). Ten of the problems involved troubleshooting, two involved removal and replacement of hardware and two involved soldering. With an average of 1.5 "assists" per troubleshooting problem, the airmen were able to solve the problems in average times (for various problems) ranging from 18 to 59 minutes. The 90 "assists" were needed because of reading errors (52), misuse of multimeter (20), lack of manual dexterity (6), misuse of oscilloscope (5), and miscellaneous errors (7). On the troubleshooting tasks, the high aptitude trainees scored consistently better than the medium aptitude trainees in both time and number of assists; however, neither of these differences were statistically significant. The high aptitude group was able to complete 10 of their 30 problems without an assist while the medium aptitude group completed only two problems without an assist. On the remove and replace tasks, both groups proceeded smoothly and, with one exception, without error. In the soldering tasks, the medium aptitude group was slower but their products were of higher quality than the high aptitude group. Although the airmen did not exhibit the errorless performance that had been desired, their performance should be considered as at least promising. Causes for many of their deficiencies were identified and can be corrected. In general, the presence of the high-ranking observers seemed to disturb and slow the performance of the airmen. Also, it should be noted that no baseline is available to compare the performance of these airmen with the performance of conventionally trained airmen using conventional technical data. A training program about two weeks longer than the four week course used in this demonstration will be necessary to achieve satisfactory performance of maintenance tasks, including troubleshooting, while using FPJPAs. The FPJPAs must be completely verified to insure clarity and accuracy. Although personnel with high aptitude for electronic maintenance probably will outperform those with lower aptitude, satisfactory maintenance performance probably can be obtained from personnel of either high or medium aptitude if they are provided with job-oriented training and FPJPAs. (56 pp.)

397 **Dansereau, D.F., Actkinson, T.R., Long, G.L., & McDonald, B. Learning strategies: a review and synthesis of the current literature. AFHRL-TR-74-70, AD-A007 722. Lowry AFB, CO: Technical Training Division, December 1974. Project 1121, Contract F41609-74-C-0013, Texas Christian University. NTIS.** This report reviews and synthesizes psychological and educational research on learning strategies. The report contains an overview of strategy modification; a review of factors influencing strategy selection and use (including intellectual aptitude, personality variables, cognitive style, reception preference, motivation, sex, and prior knowledge); a review of learning strategies (general, comprehension, memory, problem solving, and creativity); and recommendations involving future research. The report develops and uses a conceptual framework providing coherence to the variety of studies which relate to research on learning strategies. The intent of this study is to provide a basis for developing specific research plans to improve students' learning strategies and skills. (92 pp.)

398 **Potter, N.R., & Dieterly, D.L. Methods for predicting and assessing the impact of technology on human resource parameters: report of the literature. AFHRL-TR-74-71, AD-A000 051. Wright-Patterson AFB, OH: Advanced Systems Division, August 1974. Project 7907, Contract F33615-74-C-4019, Systems Research Laboratories, Inc. NTIS.** A research objective of the Air Force Human Resources Laboratory is the development of methods for defining the components of innovative technology and for measuring the effects of the incoming technology on Air Force human resources. The human resource parameters of concern include manpower (e.g., numbers, job types, skill levels), training considerations, and cost data. Earlier investigations established the feasibility of using human resources data in design trade studies and of determining and graphically depicting the array of trade-off options available before inception of hardware design. The purpose of this review was to establish the current status of the methodology for forecasting and assessing technology and for quantizing human resource parameters with respect to the impact of incoming technologies. A search and critical analysis of the literature was undertaken to review the status of forecasting and assessing technology and of techniques for predicting the impact of technology on human resource parameters. The size of the literature base in the area of technological forecasting and technology assessment precluded the conduct of an exhaustive review. Rather, the determination was made that inclusion of selected references which described current methodologies in detail and which were judged as representative would better satisfy the objectives of the research effort. A total of 140 documents applicable to this effort were reviewed. Seventeen of these were identified as having major significance to the present effort. The review of the literature failed to provide solution to the problem of quantizing human resource parameters with respect to impact of incoming technologies. However, the use of a normative forecasting technique was strongly supported by the literature. In particular, a relevance tree approach was the technique viewed as amenable to the problem of successive identification of increasingly finer components in an organized, structured manner. The relevance tree procedure known as a Design Option Decision Tree was identified as practical for detailing a system to a level permitting the identification and assessment of human resource components for impact quantification. (96 pp.)

399 **Yasutake, J.Y. The effects of pacing and mode of adjunct questions on short and long term retention of written materials. AFHRL-TR-74-72, AD-A005 295. Lowry AFB, CO: Technical Training Division, October 1974. Project 1121. NTIS.** This report summarizes the results of a study to determine the overall effectiveness of adjunct programming techniques and to determine further whether the form and frequency of self test questions contained in the adjunct program have differential effects on learning. Four formats of adjunct programs were used by different groups as a supplement while reading text on military justice. A fifth group read the text without the aid of an adjunct program. Results are discussed in terms of short and long term retention effects and on the retention of incidental and relevant information. (74 pp.)

400 **Samers, B.N., Dunham, A.D., & Nordhauser, F. Evaluation of methodology for estimating the cost of Air Force on-the-job training. AFHRL-TR-74-73, AD-A005 298. Lackland AFB, TX: Manpower and Personnel Systems Division, November 1974. Project 2077, Contract F41609-72-C-0048, Cooper and Co. NTIS.** This report describes the final phase of a study directed at the development of an on-the-job training (OJT) costing methodology. Utilizing a modification of survey techniques tested and evaluated during the previous phase, estimates were obtained for the cost of OJT for airman training from the 1-level (unskilled) to the 3-level (semi-skilled) in five category B Air Force specialties. The specialties studied were pavement maintenance (551X0); fire protection (571X0); food service (622X0); fuel service (631X0); and materiel facilities (647X0). The cost per graduate of OJT for these specialties was compared to the cost per graduate of resident school technical training. For three of the five specialties, OJT cost per graduate was below the technical training school cost per graduate. Supervisors were surveyed to determine if there was a difference in performance between OJT and technical school graduate in these AFSCs. As was true in

the previous phase, no evidence was obtained to support the hypothesis that either OJT or technical school graduates were superior in performance. Conditional cost models were also formulated and tested. The conditional cost models are based on an alternative or opportunity cost concept and represent a refinement of the original cost models. (60 pp.)

401 **Beusse, W.E. Utilization of veterans' benefits by Army new standards FY 1969 separatees. AFHRL-TR-74-74, AD-785 384. Alexandria, VA: Manpower and Personnel Systems Division, March 1974. Project 4499. NTIS.** This study provides information on the utilization of veterans' benefits by Army New Standards separatees. Information is presented concerning: their knowledge of their V.A. benefits; past, present, and anticipated use of educational benefits; their need for and use of medical benefits; their use of employment assistance; and their use of other V.A. benefits. The results indicate that a majority of the New Standards veterans were aware of their veterans' benefits. Although many made use of their benefits, there appeared to be room for increasing the low aptitude veteran's utilization of these programs. (30 pp.)

402 **Beusse, W.E. The impact of military service on low aptitude men. AFHRL-TR-74-75, AD-785 394. Alexandria, VA: Manpower and Personnel Systems Division, February 1974. Project 4499. NTIS.** The purpose of this study was to examine the impact of military experience upon the post-service lives of low aptitude men. The data were collected by interview on a set of 477 Army New Standards FY 1969 separatees and 477 nonveterans who were matched by race, educational level, age, geographic location, and were within a narrow AFQT range.

The literature concerning the theoretical post-service effects of military service was reviewed. Also, the results of a number of empirical studies dealing with the effects of military service upon post-service economic status were examined.

The results of the data analysis indicate that military service has a positive impact upon the post-service lives of low aptitude men. Compared to their nonveteran twins, it was found that veterans were more likely to (1) complete their high school education or obtain a GED, (2) be employed in the higher skilled, higher paying occupations and industries, (3) have joined a union, and (4) to have migrated from the geographic region in which they resided at age 18.

It was also found that veterans earn significantly higher wages than nonveterans. Veterans fared better than nonveterans within each racial-educational subgroup. These income differences were found to be independent of unmatched background characteristics. (50 pp.)

403 **Irish, K.M., & Orszulak, J.H. Visual simulation video processing techniques. AFHRL-TR-74-76, AD-A009 640. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 6114, Contract F33615-73-C-4057, Systems Research Laboratories, Inc. NTIS.** This report describes a two-phase program to further the development of visual simulation video processing techniques as applied to a wide angle optical probe/TV camera. Phase I of the program included the study of applicable wide-angle display techniques, study of additional processing of the probe's video signal for proper mating to a display, study of color visual requirements, and a review of state-of-the-art separation techniques for TV cameras. Phase II of the program dealt with the construction of a video matrix generator to provide the necessary electronic processing to mate the optical probe/TV camera system to applicable wide angle displays. The conclusions reached were that a matrix of display elements is necessary for a compact and realistic wide-angle display, and a color TV camera could be developed using present technology to mate with the Farrand wide-angle optical probe. (176 pp.)

404 **Brown, J.S., Bell, A.G., & Burton, R.R. Sophisticated instructional environment for teaching electronic troubleshooting. AFHRL-TR-74-77, AD-A002 148. Lowry AFB, CO: Technical Training Division, October 1974. Project 1121, Contract F41609-73-C-0006, University of California, Irvine. NTIS.** This report describes the programming approach used to implement a simulated laboratory

training situation in which a student is allowed to troubleshoot a defective regulated power supply. The ways in which students can use English to ask questions about and manipulate the simulated device are described. The techniques developed to recognize English, to simulate the electronic circuit, and to model the student's knowledge about the circuit are explained. A conclusions section explains the generality of the work performed, and possible extensions of the techniques to other training situations. (144 pp.)

405 **Woodruff, R.R., & Smith, J.F. T-4G simulator and T-4 ground training devices in USAF undergraduate pilot training. AFHRL-TR-74-78, AD-A008 197. Williams AFB, AZ: Flying Training Division, November 1974. Project 1123. NTIS.** Twenty-one *Ss* selected from three Undergraduate Pilot Training classes were given contact flight training in a T-4G/EPT simulator before going to T-37 aircraft for further training. Fourteen of these *Ss* were also given instrument training in the T-4G/EPT before completing such training in the aircraft. The remaining seven *Ss* received instrument training in the UPT T-4 instrument and procedures trainer. A specially designed syllabus was used which incorporated batch training, proficiency advancement, and other revised instructional strategies. Check pilot scores for each of the instructional phases were used in comparing performances of the experimental *Ss* with those of the conventionally trained students. Results indicate devices having the capabilities of the T-4G could be used to achieve an average saving per student of three aircraft hours in contact flight training and ten hours in instrument training. Results also indicate a savings of eight aircraft hours could be achieved in instrument training by using the specially devised syllabus of instruction with existing T-4 instrument trainers. (24 pp.)

406 **Haygood, R.C., Leshowitz, B., Parkinson, S., & Eddowes, E.E. Visual and auditory information processing aspects of the acquisition of flying skill. AFHRL-TR-74-79, AD-A007 721. Williams AFB, AZ: Flying Training Division, December 1974. Project 1138, Contract F41609-72-C-0037, Arizona State University. NTIS.** The result of a number of experimental studies of human auditory and visual information processing behavior and their possible relationship to the student pilot's acquisition of flying skill were explored in terms of conceptual model developed for this study. The results were interpreted in terms of the potential interfering effects of the intake of and response to information processed during flying tasks and in terms of the student pilot's nonoptimal information processing strategies during his acquisition of flying skill. It was concluded that the experimental procedures employed could be adapted successfully for research in the area and that the relationships found between information processing and flying skill warranted their further study. (62 pp.)

407 **Beusse, W.E. Documentation of the 1973 DOD personnel survey. AFHRL-TR-74-80, AD-785 385. Alexandria, VA: Manpower and Personnel Systems Division, May 1974. Project 4499, Contract F41609-73-C-0030, Human Resources Research Organization (HumRRO). NTIS.** The 1973 DoD Personnel Survey was administered as part of the Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs) research program. The purpose of the survey was to provide DoD officials with information on the attitudes of servicemen toward a number of DoD-wide programs, policies and issues. This report documents the survey development, administration procedures and processing of the data. (102 pp.)

408 **Headquarters Air Force Human Resources Laboratory. Fiscal year 1975 -- Air Force technical objective document. AFHRL-TR-74-81, AD-A002 154. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, September 1974. (Covers all AFHRL projects). NTIS.** This document provides the academic and industrial R&D community with a summary of the technical area objectives of Air Force research in the field of human resources. The areas covered are: (a) Personnel Systems Technology and Utilization; (b) Education and Training Technology; (c) Performance Evaluation; and (d) Human Resources Data and Systems Design and Operation. (20 pp.)

409 **Hawkins, M.D., Crow, R., & Haltman, H. Cost estimates and implications of alternative configurations of an advanced personnel procurement system (APPS). AFHRL-TR-74-82, AD-A011 619. Lackland AFB, TX: Manpower and Personnel Systems Division, June 1974. Project 2077. NTIS.** This study estimates operating, equipment installation and other start up costs of replacing the USAF Recruiting Service's semi-automated Accessions Control (ACC) by an on-line real time, computerized job reservation and person-job match system. The implications (including benefits) of such a system, referred to as an Advanced Personnel Procurement System (APPS), are also discussed. There are a number of ways that APPS can be configured and each configuration will have significant effects on how the Air Force conducts its recruiting efforts. For this reason, the costs and benefits of each configuration are compared so that decision makers can decide upon the best configuration. (42 pp.)

410 **Weissmuller, J.J., Barton, B.B., & Rogers, C.R. CODAP: source program listings for the UNIVAC 1108. AFHRL-TR-74-83, AD-A004 084. Lackland AFB, TX: Computational Sciences Division, October 1974. Project 7734. NTIS.** The Comprehensive Occupational Data Analysis Programs (CODAP) package is a highly interactive and efficient system of computer routines for analyzing, organizing, and reporting occupational information. Since its inception in 1960, CODAP has grown in tandem with advances in job analysis methodology and is now capable of answering most of the wide variety of management questions which confront CODAP users. This documentation of the UNIVAC 1108 CODAP system is being published in a series of 3 technical reports covering the control card and programming aspects of the system. A fourth report is in preparation by the Occupational Research Division of AFHRL which covers the research and operational applications of the CODAP system. This document contains the source programs for the UNIVAC 1108 version of CODAP. This includes 34 FORTRAN main programs, 78 FORTRAN and 20 Assembly Language subroutines. Additionally, a table of contents, an introduction, an entry point table, and an index are provided. (536 pp.)

411 **Stacey, W.D., Weissmuller, J.J., Barton, B.B., & Rogers, C.R. CODAP: control card specifications for the UNIVAC 1108. AFHRL-TR-74-84, AD-A004 085. Lackland AFB, TX: Computational Sciences Division, October 1974. Project 7734. NTIS.** The Comprehensive Occupational Data Analysis Programs (CODAP) package is a highly interactive and efficient system of computer routines for analyzing, organizing, and reporting occupational information. Since its inception in 1960, CODAP has grown in tandem with advances in job analysis methodology and is now capable of answering most of the wide variety of management questions which confront CODAP users. This documentation of the UNIVAC 1108 CODAP system is being published in a series of 3 technical reports covering the control card and programming aspects of the system. A fourth report is in preparation by the Occupational Research Division of AFHRL which covers the research and operational applications of the CODAP system. This document contains control card writeups for the 34 main programs in the UNIVAC 1108 version of CODAP. These writeups are preceded by a short summary of the program functions. The summaries and the writeups which follow are arranged alphabetically by program name. Each writeup includes detailed control card specifications necessary to use the CODAP system. Also contained in each writeup are general input-output specifications, general program logic, and diagnostic aids. (204 pp.)

412 **Weissmuller, J.J., Barton, B.B., & Rogers, C.R. CODAP: programmer notes for the subroutine library on the UNIVAC 1108. AFHRL-TR-74-85, AD-A004 086. Lackland AFB, TX: Computational Sciences Division, October 1974. Project 7734. NTIS.** The Comprehensive Occupational Data Analysis Programs (CODAP) package is a highly interactive and efficient system of computer routines for analyzing, organizing, and reporting occupational information. Since its inception in 1960, CODAP has grown in tandem with advances in job analysis methodology and is now capable of answering most of the wide variety of management questions which confront CODAP users. This documentation of the UNIVAC 1108 CODAP system is being published in a series of 3 technical

reports covering the control card and programming aspects of the system. A fourth report is in preparation by the Occupational Research Division of AFHRL which covers the research and operational applications of the CODAP system. This document contains programmer notes on 100 library subroutines used by the current UNIVAC 1108 version of CODAP. After a table of entry points, the writeups appear in alphabetical order on subroutine name. Each writeup includes a summary of subroutine functions and a list of entry points. For each entry point, a calling sequence with descriptions of input and output arguments is provided. Comments on peculiar requirements for conversion and use of the subroutine close each writeup. (180 pp.)

413 **LeMaster, W.D., & Gray, T.H. Ground training devices in job sample approach to UPT selection and screening. AFHRL-TR-74-86, AD-A009 995. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123. NTIS.** The purpose of this study was to develop a screening procedure for undergraduate pilot training (UPT). This procedure was based upon the use of ground-based instrument trainers in which UPT candidates, naive to flying, were evaluated in their performance of job sample tasks; i.e., basic instrument flying. Training and testing sessions were conducted in a highly standardized and tightly controlled environment. Student performance was scored using only objective measures of aircraft control and systems management. The job sample approach proved highly successful in predicting student performance in the T-37 phase of UPT. Attrition, due to causes other than a lack of flying skill, was not satisfactorily predicted by this approach. (58 pp.)

414 **Connelly, E.M., Bourne, F.J., Loental, D.G., & Knoop, P.A. Computer-aided techniques for providing operator performance measures. AFHRL-TR-74-87, AD-A014 330. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 6114, Contract F33615-72-C-2094, Quest Research Corp. NTIS.** This report documents the theory, structure, and implementation of a performance measurement processor (written in FORTRAN IV) that can accept performance demonstration data representing various levels of operator's skill and, under user control, analyze data to provide candidate performance measures and validation test results. The processor accepts two types of information: (1) sample performance data on magnetic tape and (2) user information reflecting knowledge about features of the performance that are considered to be important to measurement. The sample performance data input is smoothed by the processor in order to remove or reduce noise factors in accordance with information provided by the user. Criterion performance functions are, optionally, provided by the user or are computed by the processor using skilled performers' data. The processor then develops a discrete representation of continuous performance data based on observed deviations from the criterion functions. This discrete representation, in turn, is used to model each performance using state-space techniques. The processor operates on the state-space model to compute vectors which form generators of various conceivable measure spaces. Candidate performance measures are then generated by operating in the vectors with multiple regression algorithms. Empirical validation tests of several types are applied to the candidate measures for assessment of their validity-likelihood. The processor can be applied to measurement problems where the human operator working with his equipment obtains demonstrations of various levels of performance. These potential applications include those situations where criterion performance cannot be quantitatively predefined and/or the existing definitions are ambiguous. Demonstration of some portions of the processor was accomplished using limited flight demonstration data from an instrumented T-37B aircraft for five undergraduate pilot training (UPT) maneuvers: (1) Barrel Roll, (2) Lazy 8, (3) Cloverleaf, (4) Split S, and (5) Normal Landing. (84 pp.)

415 **Connelly, E.M., Bourne, F.J., Loental, D.G., Migliaccio, J.S., Burchick, D.A., & Knoop, P.A. Candidate T-37 pilot performance measures for five contact maneuvers. AFHRL-TR-74-88, AD-A014 331. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 6114, Contract F33615-72-C-2028, Quest Research Corp. NTIS.** The objective of this program was to develop candidate pilot performance measures for five undergraduate pilot training (UPT) contact

training maneuvers flown in the T-37B aircraft. The work included development and application of a method of analyzing operator performance tasks for purposes of identifying candidate measures. This resulted in sectoring of each T-37B maneuver into functional segments, wherein the dominant measurement variables are consistent, and task segments, wherein the relationships among the dominant measurement variables are consistent. Several types of measures were then defined which, collectively, satisfy measurement needs over all task segments. Specific candidate measurement formulae were developed for each segment in accordance with the analysis results. Computer programs (FORTRAN IV) were developed and implemented to: (1) smooth, print out, and plot data recorded on-board a T-37B aircraft; (2) automatically detect task segment boundaries; (3) compute criterion functions from skilled performer's data; (4) compute measures specified at run-time by the user; and (5) perform and print results of several empirical validation tests of the candidate measures for subsequent researcher analysis. (88 pp.)

416 **Whalen, G.V., & Askren, W.B. Impact of design trade studies on system human resources. AFHRL-TR-74-89, AD-A009 639. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 1124, Contract F33615-73-C-4150, McDonnell Douglas Astronautics Company–East. NTIS.** This study was undertaken to accomplish two objectives. The first objective was to identify and classify the characteristics of conceptual design trade studies that have high potential impact on human resource requirements of Air Force weapon systems. The approach used was a case history review and analysis of 129 F-15 aircraft design trade studies. The analysis indicated that the avionics system demonstrated the greatest impact on human resources. It was also found that trade studies dealing with design alternatives that encompass widely different technologies have substantial impact on human resources. The types of human resources data (HRD) most influenced by alternative design options were maintenance task times and personnel costs. The second study objective was to determine the accuracy of using subjective estimates as a technique for deriving the HRD impact of trade study options. Using only engineering information for six avionics subsystems, from the conceptual design phase, Air Force maintenance technicians made subjective estimates of the impact of the designs on selected HRD items. It was found that technicians can make highly accurate estimates of the amount of time, the Air Force occupational specialty, the level of technical skill and the number of personnel needed to perform field maintenance tasks. (66 pp.)

417 **Mockovak, W.P. Literacy skills and requirements in Air Force career ladders. AFHRL-TR-74-90, AD-A008 770. Lowry AFB, CO: Technical Training Division, December 1974. Project 1121. NTIS.** In a previous study (Mockovak, 1974b), a methodology for estimating the reading demands of training literature, as well as the average reading ability of groups of airmen, was demonstrated in five technical training areas. The methodology was designed to be objective, inexpensive, not overly time consuming, and simple enough to be accomplished by Air Force subject matter experts.

In the present study, this methodology was applied to 56 career ladders by Air Force subject matter experts in an effort to determine: (1) the reading demands of different career ladders, (2) the average reading grade level of personnel in those ladders, and (3) the reading demands of different training materials (CDCs, TOs, and resident training literature).

In general, the results indicate a wide variation in both reading skills and requirements, within, as well as between career ladders. (34 pp.)

418 **Cyrus, M.L., & Woodruff, R.R. Grading system for T-4G simulator students in UPT studies. AFHRL-TR-74-91, AD-A004 605. Williams AFB, AZ: Flying Training Division, November 1974. Project 1123. NTIS.** The Air Force Human Resources Laboratory, Flying Training Division, engages in the evaluation of new flying training technology. One research technique used is to determine savings in training time which results when new technology is used. This is done by comparing the performance of students trained the new way with that of students trained in the usual way. A

possible result is that experimental students receive less training in the air than other students. A correction to experimental subjects' flying grades to compensate for possible reduced flying hours, is believed to be necessary. This report describes a mathematical technique developed for this purpose. The desired function is basically an optimum linear combination of new training and aircraft performance, with an additional non-linear term to correct for non-linear items inherent in the overall subjective grading system currently used by ATC. (10 pp.)

419 **Spangenberg, R.W. Tryout of a general purpose simulator in an Air National Guard training environment. AFHRL-TR-74-92, AD-A009 993. Lowry AFB, CO: Technical Training Division, December 1974. Project 1121. NTIS.** An evaluation of the usability, effectiveness, and acceptance in a job environment was performed on a general purpose simulator using a simulation of a radar system. General purpose simulators permit sharing of a programmable capability among simulations, thus providing economical hands-on training and training not usually economically available by other means. Training and exercises in malfunction isolation were given Air National Guard personnel. Data obtained using questionnaires, a performance test, and interviews indicated that the simulation was usable, effective and acceptable. However, the requirement for articulating predictive principles for guiding simulation design was indicated. (18 pp.)

420 **Brown, J.S., Burton, R.R., Bell, A.G., & Bobrow, R.J. SOPHIE: a sophisticated instructional environment. AFHRL-TR-74-93, AD-A010 109. Lowry AFB, CO: Technical Training Division, December 1974. Project 1121, Contract F41609-74-C-0015, Bolt, Beranek and Newman, Inc. NTIS.** The SOPHIE program, which implements mixed initiative CAI within a simulated electronics troubleshooting training laboratory interaction, has been extended in several manners. The language processor now accepts ellipses and other nonspecific requests and resolves these from dialogue context. A help requesting facility has been provided which will suggest possible faults (based on the student's knowledge about the circuit at the time of request) which could explain the symptoms he has observed. The net effect of modifications is that a dialogue is much more like a conversation with a very-skilled tutor who can infer what a student means, based on a complete interaction session, and respond appropriately. The resulting program can be accessed through the ARPA network of computers. (48 pp.)

421 **Mullins, C.J., Weeks, J.L., & Vitola, B.M. Variables related to hallucinogen use. AFHRL-TR-74-95, AD-A011 615. Lackland AFB, TX: Personnel Research Division, December 1974. Project 7719. NTIS.** A sample of 1,283 self-admitted, pre-service hallucinogen users was compared with an equivalent sample of airmen who had no known record of drug abuse. The results of this study indicate that it is highly probable that hallucinogen users have used other drugs. There are relationships between hallucinogen use and geographic area of enlistment, aptitude scores, educational level, age at enlistment, and religious preference. Hallucinogen use is also related to the probability of receiving an undesirable discharge, to APR, and promotion rate. (24 pp.)

422 **Hoskins, J.A. Effects of accession quality on TOPCAP objective force structure. AFHRL-TR-74-96, AD-A009 994. Lackland AFB, TX: Manpower and Personnel Systems Division, December 1974. Project 2077. NTIS.** This report utilizes the methodologies advanced in AFHRL-TR-74-64, *Modified TOPCAP Objective Force Structure Model.* It is an effort to evaluate trade offs between the "quality" of personnel entering the enlisted career force and the effects on the TOPCAP (Total Objective Plan for Career Airman Personnel) objective force configuration. (22 pp.)

423 **Maher, F.A., & York, M.L. Simulating maintenance manning for new weapon systems: maintenance manpower management during weapon system development. AFHRL-TR-74-97(I), AD-A011 986. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 1124. NTIS.** The Air Force Human Resources Laboratory, in conjunction with Headquarters Air

Force Systems Command and the Aeronautical Systems Division, has developed and implemented a new method for determining and evaluating the maintenance manning required for new weapon systems. Key features of the new approach are: 1. Manning requirements are determined by dynamic simulation of maintenance work to support specific operational scenarios. The number of people needed to support the same aircraft and flying hour program varies greatly with basing and deployment, mission types, and sortie length. 2. Manning is based on required availability, not just on the sum of man-hours worked. While worktime is a major consideration, equipment does not break on a schedule and combat aircraft cannot always fly on a schedule that provides an even workload. 3. Maintenance frequencies and job requirements for a new system are extrapolated from Air Force experience with similar equipment, adjusted for differences in design and environment. The total time a man is tied up on a job is explicitly modeled, not just "wrench turning" time. 4. Output is in a format compatible with the Air Force manpower authorization system. This approach provides more realistic and useable estimates of manning requirements and focuses on how both a contractor's design and Air Force operational procedures contribute to maintenance cost. As soon as the new aircraft configuration can be defined, comparable equipment and design differences are identified at subsystem level. Maintenance data on comparable equipment is processed through a series of specially designed programs. These data are the basis for developing initial estimates of the frequency, time, and resources for each maintenance task when modified by the judgment of experienced maintenance technicians and project engineers. The logistics and operational concepts, basing maintenance organization, and flying schedules are developed in detail for various scenarios and set down in explicit form for input to the simulation. The simulation attempts to generate the specified missions in the computer. Aircraft are turned and maintenance accomplished as they break or need service according to the task data specified in the input. Manning levels in the various work centers are constrained on successive runs until further reduction prevents the necessary number of missions from getting off. The results of various simulation runs are integrated in a final series of computer programs that computes manning in each work center for any flying program within the simulated range, adds authorized overhead, adjusts for grade level limitations, and produces a complete basic authorization document for maintenance manning in the required format. The methodology and models have been successfully applied on the A-10 program and are being considered for implementation on other aeronautical systems in or entering development. Work is underway in conjunction with Air Force Logistics Command to incorporate this methodology into a system for total logistics trade offs and life cycle costing. (34 pp.)

424 **Tetmeyer, D.C., & Moody, W.D. Simulating maintenance manning for new weapon systems: building and operating a simulation model. AFHRL-TR-74-97(II), AD-A011 987. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 1124. NTIS.** The Air Force Human Resources Laboratory, in conjunction with Headquarters Air Force Systems Command and the Aeronautical Systems Division, has developed and implemented a new method for determining and evaluating the maintenance manning required for new weapon systems. Key features of the new approach are: 1. Manning requirements are determined by dynamic simulation of maintenance work to support specific operational scenarios. The number of people needed to support the same aircraft and flying hour program varies greatly with basing and deployment, mission types, and sortie length. 2. Manning is based on required availability, not just on the sum of manhours worked. While worktime is a major consideration, equipment does not break on schedule and combat aircarft cannot always fly on a schedule that provides an even workload. 3. Maintenance frequencies and job requirements for a new system are extrapolated from Air Force experience with similar equipment, adjusted for differences in design and environment. The total time a man is tied up on a job is explicitly modeled, not just "wrench turning" time. 4. Output is in a format compatible with the Air Force manpower authorization system. This approach provides more realistic and useable estimates of manning requirements and focuses on how both a contractor's design and Air Force procedures contribute to maintenance cost. As soon as the new aircraft configuration can be defined, comparable

equipment and design differences are identified at subsystem level. Maintenance data on comparable equipment are processed through a series of specially designed programs. These data are the basis for developing initial estimates of the frequency, time, and resources for each maintenance task when modified by the judgement of experienced maintenance technicians and project engineers. The logistics and operational concepts, basing, maintenance organization and flying schedules are developed in detail for various scenarios and set down in explicit form for input to the simulation. The simulation attempts to generate the specified missions in the computer. Aircraft are turned and maintenance accomplished as they break or need service according to the task data specified in the input. Manning levels in the various work centers are constrained on successive runs until further reduction prevents the necessary number of missions from getting off. The results of various simulation runs are integrated in a final series of computer programs that computes manning in each work center for any flying program within the simulated range, adds authorized overhead, adjusts for grade level limitation, and produces a complete basic authorization document for maintenance manning in the required format. The methodology and models have been successfully applied on the A-10 program and are being considered for implementation on other aeronautical systems in or entering development. Work is underway in conjunction with Air Force Logistics Command to incorporate this methodology into a system for total logistics tradeoffs and life cycle costing. This volume describes the procedures to build a maintenance simulation data base for a new aircraft, to run it with the Logistics Composite Model (LCOM) computer program, and to use the results to predict the maintenance manning required for a new aircraft flying a specific operations scenario. Computer programming knowledge is not necessary to follow and apply this instruction. The procedures presented have been tested and used at the Aeronautical Systems Division of Air Force Systems Command in building and operating simulation models of A-10 and A-7 aircraft. (140 pp.)

425 **Tetmeyer, D.C., Nichols, S.R., & Deem, R.N. Simulating maintenance manning for new weapon systems: maintenance data analysis programs. AFHRL-TR-74-97(III), AD-A025 342. Wright-Patterson AFB, OH: Advanced Systems Division, May 1976. Project 1124. NTIS.** There is a need for a more responsive method for predicting maintenance manpower requirements for aircraft systems during development. This method should provide early estimates for use in trade-offs and evaluations, and should be sensitive to the ways in which the new aircraft will be employed. A maintenance manpower simulation model was developed. In using the model, early estimates of maintenance task data for the new aircraft are based on Air Force experience with comparable subsystems and equipment on existing aircraft, factored for the new design and environment. These data are meshed with a detailed operations scenario and support concept assumptions in a model run on the Logistics Composite Model (LCOM) simulation program. The simulation output is iterated and analyzed in post-processor programs whose final output is a complete basic manning authorization document. This approach was evaluated by applying it to the A-10 Weapon System. This entire effort is reported in a 6-volume technical report.

This volume has been updated to be consistent with changes in the Air Force maintenance data collection system effective 1 July 1975. In addition, improved capability to synthesize an output from a combination of input data sources has been added.

The series of computer programs described in this volume process available Air Force maintenance data from existing aircraft and put it in a form that can be used for developing maintenance task estimates on comparable equipment planned for new aircraft. Primary inputs are the standard six month maintenance tape kept at base level and corresponding operational summaries from the AFM 65-110 data system. A variety of outputs can be obtained at user's option to display data on unscheduled flight line work, unscheduled maintenance in phase, engine shop work, and field shop work, each to the desired level of detail.

Typical output data include mean sorties between maintenance actions, task sequencing, task times, maintenance crew sizes, and maintenance crew composition. The programs are currently in operation on the Aeronautical Systems Division's CDC 6600 computer. (318 pp.)

426 **Hicks, V.B., & Tetmeyer, D.C. Simulating maintenance manning for new weapon systems: data base management programs. AFHRL-TR-74-97(IV), AD-A011 989. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 1124. NTIS.** The Air Force Human Resources Laboratory, in conjunction with Headquarters Air Force Systems Command and the Aeronautical Systems Division, has developed and implemented a new method for determining and evaluating the maintenance manning required for new weapon systems. Key features of the new approach are: 1. Manning requirements are determined by dynamic simulation of maintenance work to support specific operational scenarios. The number of people needed to support the same aircraft and flying hour program varies greatly with basing and deployment, mission types, and sortie length. 2. Manning is based on required availability, not just on the sum of man-hours worked. While worktime is a major consideration, equipment does not break on schedule and combat aircraft cannot always fly on a schedule that provides an even workload. 3. Maintenance frequencies and job requirements for a new system are extrapolated from Air Force experience with similar equipment, adjusted for differences in design and environment. The total time a man is tied up on a job is explicitly modeled, not just "wrench turning" time. 4. Output is in a format compatible with the Air Force manpower authorization system. This approach provides more realistic and useable estimates of manning requirements and focuses on how both a contractor's design and Air Force procedures contribute to maintenance cost. As soon as the new aircraft configuration can be defined, comparable equipment and design differences are identified at subsystem level. Maintenance data on comparable equipment is processed through a series of specially designed programs. These data are the basis for developing initial estimates of the frequency, time, and resources for each maintenance task when modified by the judgment of experienced maintenance technicians and project engineers. The logistics and operational concepts, basing, maintenance organization, and flying schedules are developed in detail for various scenarios and set down in explicit form for input to the simulation. The simulation attempts to generate the specified missions in the computer. Aircraft are turned and maintenance accomplished as they break or need service according to the task data specified in the input. Manning levels in the various work centers are constrained on successive runs until further reduction prevents the necessary number of missions from getting off. Computer programs used in the final stage of the maintenance manpower simulation modeling process integrate direct work center manning output from a number of simulation runs; add supervision, overhead requirements, and standard element manning; and apply appropriate grade spread criteria. The output is a complete basic authorization document for maintenance manning, compatible with Air Force manpower authorization procedures. The program may be exercised to obtain manning for any proposed flying rate with the simulated range and has an option for adjusting existing equations with new data representing updated or alternative conditions. The series of COBOL and FORTRAN computer programs described in this volume was developed to permit a Logistics Composite Model (LCOM) maintenance data base to be constructed in simplified format with all the data describing a single task contained on one punch card or magnetic file record. The programs translate the task data into the necessary LCOM inputs and incorporate a number of useful diagnostic checks which eliminate the more frequently encountered data preparation errors. Use of these programs simplifies data base development, update, and control. They are currently in operation on the Aeronautical Systems Division's CDC 6600 computer. The methodology and models have been successfully applied on the A-10 program and are being considered for implementation on other aeronautical systems in or entering development. Work is underway in conjunction with Air Force Logistics Command to incorporate this methodology into a system for total logistics trade-offs and life cycle costing. (50 pp.)

427 **Moody, W.D., Tetmeyer, D.C., & Nichols, S.R. Simulating maintenance manning for new weapon systems: manpower programs. AFHRL-TR-74-97(V), AD-A011 990. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 1124. NTIS.** The Air Force Human Resources Laboratory, in conjunction with Headquarters Air Force Systems Command and the Aeronautical Systems Division, has developed and implemented a new method for determining and evaluating the maintenance manning required for new weapon systems. Key features of the new

approach are: 1. Manning requirements are determined by dynamic simulation of maintenance work to support specific operational scenarios. The number of people needed to support the same aircraft and flying hour program varies greatly with basing and deployment, mission types, and sortie length. 2. Manning is based on required availability, not just on the sum of man-hours worked. While worktime is a major consideration, equipment does not break on schedule and combat aircraft cannot always fly on a schedule that provides an even workload. 3. Maintenance frequencies and job requirements for a new system are extrapolated from Air Force experience with similar equipment, adjusted for differences in design and environment. The total time a man is tied up on a job is explicitly modeled, not just "wrench turning" time. 4. Output is in a format compatible with the Air Force manpower authorization system. This approach provides more realistic and useable estimates of manning requirements and focuses on how both a contractor's design and Air Force procedures contribute to maintenance cost. As soon as the new aircraft configuration can be defined, comparable equipment and design differences are identified at subsystem level. Maintenance data on comparable equipment is processed through a series of specially designed programs. These data are the basis for developing initial estimates of the frequency, time, and resources for each maintenance task when modified by the judgment of experienced maintenance technicians and project engineers. The logistics and operational concepts, basing, maintenance organization, and flying schedules are developed in detail for various scenarios and set down in explicit form for input to the simulation. The simulation attempts to generate the specified missions in the computer. Aircraft are turned and maintenance accomplished as they break or need service according to the task data specified in the input. Manning levels in the various work centers are constrained on successive runs until further reduction prevents the necessary number of missions from getting off. The pair of computer programs documented in this volume are used in the final stage of the maintenance manpower simulation modeling process. They integrate direct work center manning output from a number of simulation runs; add supervision, overhead requirements, and standard element manning; and apply appropriate grade spread criteria. The output is a complete basic authorization document for maintenance manning, compatible with Air Force manpower authorization procedures. The program may be exercised to obtain manning for any proposed flying rate within the simulated range, and has an option for adjusting existing equations with new data representing updated or alternative conditions. The methodology and models have been successfully applied on the A-10 program and are being considered for implementation on other aeronautical systems in or entering development. Work is underway in conjunction with Air Force Logistics Command to incorporate this methodology into a system for total logistics tradeoffs and life cycle costing. (84 pp.)

428 **Tetmeyer, D.C., Nichols, S.R., Hart, W.L., & Maher, F.A. Simulating maintenance manning for new weapon systems: maintenance manpower matrix program. AFHRL-TR-74-97(VI), AD-A025 311. Wright-Patterson AFB, OH: Advanced Systems Division, May 1976. Project 1124. NTIS.** There is a need for a more responsive method for predicting maintenance manpower requirements for aircraft systems during development. This method should provide early estimates for use in trade-offs and evaluations, and should be sensitive to the ways in which the new aircraft will be employed. A maintenance manpower simulation model was developed. In using the model, early estimates of maintenance task data for the new aircraft are based on Air Force experience with comparable subsystems and equipment on existing aircraft, factored for the new design and environment. These data are meshed with a detailed operations scenario and support concept assumption in a model run on the Logistics Composite Model (LCOM) simulation program. The simulation output is iterated and analyzed in post-processor programs whose final output is a complete basic manning authorization document. This entire effort is reported in a 6-volume technical report.

This volume documents the computer program which is used in the final stage of the maintenance manpower simulation process. It integrates direct work center manning output from a simulation run. The output is a graphic presentation of the manpower demands compiled across a

24-hour day, depicting the number of demands for any given hour of a day. The program may be exercised to obtain demands for any proposed flying rate within the simulated range. The methodology and models have been successfully applied on the A-10 program and are being implemented on other aeronautical systems in or entering development. Work is underway, in conjunction with Air Force Logistics Command, to incorporate this methodology into a system for total logistics trade-offs and life cycle costing. (80 pp.)

429 **O'Neil, H.F., Jr., Walker, M.E., Walther, G.H., & Judd, W.A. On-line management information system: feasibility in an R&D environment. AFHRL-TR-74-98, AD-A007 723. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, December 1974. Project DALS, Contract F41609-73-C-0019, The University of Texas at Austin. NTIS.** The objectives of this study consisted of three stipulated tasks. These tasks were: (1) to conduct and document a thorough, comprehensive review of existing literature which addresses itself to implementation and evaluation of on-line data management systems; (2a) to analyze methods currently in existence within the Air Force Human Resources Laboratory (AFHRL) for processing management and planning information; and (2b) to analyze the information needs of a designated subset within the AFHRL; (3a) to develop implementation and evaluation strategies; (3b) to demonstrate and evaluate the feasibility of the strategies and techniques developed. The interim report discussed tasks (1) and (2) and provided baseline data for task (3). This final report will address itself to objective (3). (82 pp.)

430 **Boldt, R.F. An approximately reproducing scoring scheme that aligns random response and omission. AFHRL-TR-74-99, AD-A005 301. Lowry AFB, CO: Technical Training Division, November 1974. Project 1121, Contract F41609-70-C-0044, Educational Testing Service. NTIS.** One formulation of confidence scoring requires the examinee to indicate as a number his personal probability of the correctness of each alternative in a multiple-choice test. For this formulation a linear transformation of the logarithm of the correct response is maximized if the examinee accurately reports his personal probability. To equate omits scores with choice scores, the transformation can be chosen so that the score is zero if the examinee indicates complete uncertainty. If this is done, the scoring function depends on the number of alternatives. One could also align uncertainty and response omission by granting credit for omitting items, though it is felt this might be hard to explain. (8 pp.)

431 **Beusse, W.E. The impact of draft vulnerability on service academy attrition. AFHRL-TR-74-100, AD-A017 081. Alexandria, VA: Manpower and Personnel Systems Division, April 1975. Project 4499. NTIS.** The purpose of this study was to examine the relationship between draft vulnerability and attrition from the service academies. Attrition among the members of the Classes of 1972-1976 at each of the three DoD Academies was examined in relation to the individual's draft vulnerability imputed from his lottery number. The data did not indicate any strong or consistent tendency for draft-safe cadets/midshipmen to have attrited in higher proportions than men who were vulnerable to the draft. (17 pp.)

432 **Smith, E.A. Acceptance inspection for audio cassette recorders. AFHRL-TR-74-101, AD-A011 618. Lowry AFB, CO: Technical Training Division, December 1974. Project 1121. NTIS.** This technical memorandum describes a series of inspections for cassette recorders that can be performed to assure that the devices are acceptable. The inspections can be completed in 20 minutes and can be performed by instructional personnel. The series of inspection procedures includes tests of the intelligibility of audio, physical condition, tape speed, impulse reliability, response range and torque delivered to the tape. It is suggested that acceptance testing could both avoid disruption of instruction and save money by obtaining repair or replacement under the warranty on the device. (12 pp.)

433 **Reid, G.B., & Cyrus, M.L. Transfer of training with formation flight trainer. AFHRL-TR-74-102, AD-A009 638. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123. NTIS.** The present research was conducted to determine transfer of practice from a formation simulator to aircraft formation flying. Evidence in support of positive transfer was obtained by comparing students trained in the formation simulator with students who were essentially untrained and with students trained in the aircraft. This design provided data for a direct comparison of five simulator sorties with two aircraft sorties in an effort to quickly establish a training cost/transfer comparison. The results indicate that the simulator has at least the training effectiveness of two aircraft sorties. (16 pp.)

434 **Leshowitz, B., Parkinson, S., & Waag, W.L. Visual and auditory information processing in flying skill acquisition. AFHRL-TR-74-103, AD-A009 636. Williams AFB, AZ: Flying Training Division, December 1974. Project 1138, Contract F41609-74-C-0002, Arizona State University. NTIS.** This document summarizes a series of experiments conducted to study further refinements in the development of experimental paradigms for the investigation of information processing skills relevant to pilot training. A series of tasks have been developed and studied which attempt to measure the individual's information processing capacity as well as his susceptibility to performance degradation resulting from the introduction of interfering stimuli. Data suggest performance on these tasks to be highly dependent upon individual differences, therefore, making them good candidates for use as tools in the investigation of information processing skills in flying training. Implications for direct application to flying training research are discussed. (20 pp.)

435 **Tenpas, B.G., & Higgins, N.C. Practice and incentive effects on learner performance: aircraft instrument comprehension task. AFHRL-TR-74-104, AD-A011 616. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0027, Arizona State University. NTIS.** AFROTC cadets learned an aircraft instrument comprehension task by reading self-instructional materials. No significant changes in posttest scores occurred when practice items were added to the materials or when simulator rides were offered as incentives. However, cadets who practiced the task and cadets who were offered the incentive performed faster on the posttest than those who only read the materials. (28 pp.)

436 **Tenpas, B.G., Reiser, R.A., Kearns, D.R., Booth, G.E., & Deden, A.E. Systematic variations of instructional variables on learner performance: aircraft instrument comprehension task. AFHRL-TR-74-105, AD-A010 106. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0027, Arizona State University. NTIS.** Incentive, practice, instruction, and feedback were manipulated in a series of four 2 x 2 factorial studies, with AFROTC cadets and graduate students in education, to determine the individual and combined effects of these variables on learner performance of an aircraft instrument comprehension task. AFROTC cadets, who either practiced the task or were offered a performance-contingent incentive, performed significantly faster on the posttest than learners who did not receive these treatments. No significant feedback effects were observed in any of the studies. These results are discussed in terms of instruction, as the variable of singular importance in designing materials and procedures to facilitate desired learning outcomes. (50 pp.)

437 **Baran, H.A. Air Force Human Resources Laboratory military personnel costing conference. AFHRL-TR-74-106, AD-A013 171. Wright-Patterson AFB, OH: Advanced Systems Division, December 1974. Project 1124. NTIS.** This conference was the initial step in an R&D project to develop and demonstrate a family of techniques to generate standard personnel cost data for use in: (a) weapon system design engineering; (b) weapon system life cycle support operations; and (c) personnel/manpower budgeting. It was organized to provide technical guidance in directing the efforts of this project. Representatives from various organizations within Air Force Headquarters,

Tactical Air Command, Air Force Systems Command, Air Training Command, Air Force Logistics Command, and the US Naval Personnel Research Laboratory comprised the membership. The objectives were: (A) identify and summarize the various concepts and practices of personnel costing and how they relate to system engineering design, system support, and various command level personnel, manpower, and budgetary activities; (B) identify the "users" of personnel cost data, their present requirements and uses for it, and their desires for new types or formats of such data; (C) ascertain what has been accomplished by other agencies that could be adapted to satisfy in part/whole the requirements identified in objectives B and identify work currently in progress which might be applicable; and (D) summarize the most pressing research goals and requirements. (52 pp.)

438 **Woodruff, R.R., Mullen, J.T., & Winans, J.R. T-4G methodology: undergraduate pilot training T-37 phase. AFHRL-TR-74-107, AD-A012 247. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123. NTIS.** Results of an earlier study indicated that revised instructional methodologies could be used to save a significant number of T-37 aircraft hours when applied to the instrument training phase of Undergraduate Pilot Training (UPT).

To determine the operational feasibility of adopting these methodologies command-wide, Headquarters, Air Training Command directed the 82d Flying Training Wing, Williams Air Force Base, Arizona, in consultation with AFHRL, Flying Training Division personnel, to train a total UPT class using the revised procedures. ATC further directed similar procedures be applied to advanced T-38 UPT on a test basis.

This report summarizes the methods used in the T-37 phase of the project and includes a copy of the revised syllabus, the ATC-prepared evaluation report, and associated schedules and flow charts.

The potential savings demonstrated in this study averaged 42% (8.8 T-37 hours) per student for the instrument training phase and it is recommended that favorable consideration be given to command-wide application. (78 pp.)

439 **Obermayer, R.W., Vreuls, D., Muckler, F.A., Conway, E.J., & Fitzgerald, J.A. Combat-ready crew performance measurement system: final report. AFHRL-TR-74-108(I), AD-B005 517L. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0008, Manned Systems Sciences, Inc. DDC. Goals:** To improve acquisition of training performance information through usable tools, this study was directed to: (1) Systematic definition of *performance measures* appropriate to combat-training needs. (2) Definition of a cost effective *measurement system* usable in combat-crew training environments to acquire and process needed training information.

Method: Definitions of needed performance measures were based on data derived from data collection trips to Castle AFB (B-52), Altus AFB (C-141), Dyess AFB (C-130), Davis-Monthan AFB (F-4), Tyndall AFB (F-106), Luke AFB (A-7), George AFB (F-4 crew), Norton AFB (C-141 crew), Nellis AFB (F-4 ACM). System criteria were based on an analysis of combat-crew training research procedures. Design studies were performed to provide data for tradeoffs between alternative system candidates. Finally, detailed system specifications and an implementation plan were prepared.

Performance Measures: Measurement was generated in the following steps: (1) The requirements of six aircraft were consolidated into a common framework of maneuvers: Transition, Instruments, Formation, Air Combat, Air Refueling, Ground Attack, Air Drop, Radar Navigation and Bombing; (2) For each maneuver, data collected from CCTS visits were formalized into measurement requirements; (3) Measurement parameters and (4) Specifications were produced for hardware and software implications, respectively; and (5) Examination of crew interactions led to an analysis of communications measurement.

The Performance Measurement System: The performance measurement system consists of the following subsystem: (1) *Data Acquisition.* A hybrid audio/video/photo/digital recording system with

programmed recording control was derived from system tradeoff analyses. A data playback station for combined manual and automatic processing is provided. (2) *Data Processing.* A general purpose digital computer with standard peripherals is required. In addition to executive and utility programs, specialized input, edit, measurement and analysis software is needed. (3) *Personnel.* A crew consisting of the following types (1) system director, (2) research personnel, (3) computer programmer, data clerks, engineers and technicians, and secretary, is needed to perform functions leading to research objectives. (4) *Facilities.* Two mobile-home trailers are recommended to house personnel and ground-based equipment. (72 pp.)

440 **Obermayer, R.W., & Vreuls, D. Combat-ready crew performance measurement system: phase I measurement requirements. AFHRL-TR-74-108(II), AD-B005 518L. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0008, Manned Systems Sciences, Inc. DDC.** Research for the improvement of combat-crew training, and the efficient execution of current training programs, are heavily dependent upon good sources of information about trainee performance during and at the end of training. In an effort to improve training performance information, this study is directed to systematic definition of performance and development of methods for measurement. The primary goal of this study is to provide usable measurement tools for attacking problems related to combat-crew training.

The first phase of this program is devoted to the definition of requirements for information based on data-collection surveys to six selected combat-crew training sites (A-7, B-52, C-130, C-141, F-4, F-106 weapon systems). (64 pp.)

441 **Obermayer, R.W., & Vreuls, D. Combat-ready crew performance measurement system: phase II measurement system requirements. AFHRL-TR-74-108(III), AD-B005 519L. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0008, Manned Systems Sciences, Inc. DDC.** Research for the improvement of combat-crew training, and the sufficient execution of current training programs, are heavily dependent upon good sources of information about trainee performance during and at the end of training. In an effort to improve training performance information, this study is directed to (1) systematic definition of performance and (2) development of methods for measurement.

The current Phase II Report deals with the *requirements for a measurement system* to process the measurement which has been dictated by the previous reports. The following topics are included in this paper: (1) *Research procedures* to indicate the operation in which a measurement system is to serve as a tool in achieving research goals; (2) *Measurement processing* to investigate the nature of data processing associated with training research measurement; (3) *System criteria* to guide design tradeoffs; (4) *Preliminary system analyses* to establish measurement system requirements which follow rather directly from the system criteria. (30 pp.)

442 **Obermayer, R.W., & Vreuls, D. Combat-ready crew performance measurement system: phase IIIA crew performance measurement. AFHRL-TR-74-108(IV), AD-B005 520L. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0008, Manned Systems Sciences, Inc. DDC.** Research for the improvement of combat-crew training, and the efficient execution of current training programs, are heavily dependent upon good sources of information about trainee performance during and at the end of training. In an effort to improve training performance information, this study is directed to systematic definition of performance and development of methods for measurement.

In accordance with the initial definition of this study, emphasis was placed on pilot performance, but it was soon recognized that avoiding the performance contributions of other crewmembers, and the interaction between crewmembers, had more serious consequences than desired. To correct this problem, additional tasks were undertaken; in particular, additional data

collection visits were made. The original efforts included visits related to A–7, F–4, F–106, B–52, C–141, C–130 combat-crew training units. The current effort involved follow-up analyses on the F–4E and C–141A to provide additional data on fighter and heavy-multi-engine aircraft. (68 pp.)

443 **Obermayer, R.W., Vreuls, D., & Conway, E.J. Combat-ready crew performance measurement system: phase IIIC design studies. AFHRL-TR-74-108(VI), AD-B005 521L. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0008, Manned Systems Sciences, Inc. DDC.** The current Phase IIIC report deals with design studies to determine desirable system features to meet the research needs documented in the earlier reports of this sequence. Chapter II presents analyses of factors to be considered in training measurement system design. Chapter III indicates the nature of tradeoffs for each system criterion established in the Phase II report. Recommendations based on these analyses are discussed in Chapter IV. (116 pp.)

444 **Obermayer, R.W., Muckler, F.A., Vreuls, D., & Conway, E.J. Combat-ready crew performance measurement system: phase IIID specifications and implementation plan. AFHRL-TR-74-108(VII), AD-B005 522L. Williams AFB, AZ: Flying Training Division, December 1974. Project 1123, Contract F41609-71-C-0008, Manned System Sciences, Inc. DDC.** The current and seventh report presents specifications and an implementation plan for the performance measurement system recommended as a result of this program. The following chapters relate to each of the major subsystems (I. Data Acquisition, II. Data Processing, III. Personnel, and IV. Facilities) and to the steps recommended for implementation (V. Implementation Plan). The Appendix presents example equipment of the types included in this specification. (132 pp.)

445 **Tuttle, T.C., Gould R.B., & Hazel, J.T. Dimensions of job satisfaction: initial development of the Air Force occupational attitude inventory. AFHRL-TR-75-1, AD-A014 796. Lackland AFB, TX: Occupational and Manpower Research Division, June 1975. Project 7734. NTIS.** This report describes the initial development of the Air Force Occupational Attitude Inventory. From a selective review of studies that ascribed to a multi-faceted approach, several categories or content areas were identified. An extensive item pool was prepared and reviewed by judges to provide information regarding item-category agreement, item ambiguity, and item redundancy. The revised version of the inventory consisted of 348 items distributed across 35 facets. An 8-point bi-polar rating scale without a neutral point was developed for rating the items. Details regarding the final version of the inventory booklet, suitable for administration to airmen, are provided. The entire listing of 348 items and descriptions of the 35 categories are included in the report for possible use of other researchers. Subsequent actions and future uses of the Occupational Attitude Inventory are discussed. (36 pp.)

446 **Abellera, J.W., Mullins, C.J., & Earles, J.A. Value of personnel classification information. AFHRL-TR-75-2, AD-A011 617. Lackland AFB, TX: Personnel Research Division, March 1975. Project 7719. NTIS.** This study outlines the development of a methodology for meaningfully estimating the value of classification information used by the Air Force to make selection/assignment decisions which lead to the satisfaction of first-term enlisted manpower requirements. The methodology, called the optimal allocation strategy, is employed to solve a representative allocation problem in a hypothetical enlistment year. This exercise serves to show how the value of available information may be estimated when used in the most efficient manner possible. Four conclusions are drawn from the study: (1) the value of classification information currently available to the Air Force can be estimated in tangible terms, (2) the value of even better classification information which could become available in the future as a result of specific research can be estimated in tangible terms, (3) the means for getting the most out of currently available information exist, and (4) a variety of personnel policies and programs can be evaluated in terms of both real and realizable dollar payoffs. (34 pp.)

447 **Wang, W.L., Eddowes, E.E., Fuller, J.H., Jr., & Fuller, R.R. ASUPT automated objective performance measurement system. AFHRL-TR-75-3, AD-A014 799. Williams AFB, AZ: Flying Training Division, March 1975. Project 1123. NTIS.** To realize its full research potential a need exists for the development of an automated objective pilot performance evaluation system for use in the Advanced Simulation in Undergraduate Pilot Training (ASUPT) facility. The present report documents the approach taken for the development of performance measures and also presents data collected from two preliminary evaluation studies. The results indicated that the objectively derived measures: (1) correlate highly with instructor ratings, and (2) discriminate between pilots of different experience levels. These findings are encouraging and demonstrate the potential of the present approach for generating the needed automated objective pilot performance measurement system. (16 pp.)

448 **King, A.T. Impact of computer-based instruction on attitudes of students and instructors: a review. AFHRL-TR-75-4, AD-A014 797. Lowry AFB, CO: Technical Training Division, May 1975. Project 1121. NTIS.** This review examines the evidence which bears on the issue of whether contact with computer-based instruction leads to feelings of "depersonalization" or "dehumanization." The approach is to document investigations which employ the larger construct of "attitudes" toward various modes of computer-based instruction which are found to be held by students and instructors before, during, or after exposure to computer-based instruction. Evaluation of pertinent factors which influence attitudes was made through an assessment of relevant literature and personal communication with experts associated with various CAI and CMI projects in the United States. (32 pp.)

449 **Sulzen, R.H., & Thomas, D.L. The effects of adjunct instructional materials employed outside the classroom on the performance of Air Force ROTC students. AFHRL-TR-75-5, AD-A015 749. Wright-Patterson AFB, OH: Advanced Systems Division, July 1975. Project 1710. NTIS.** This study was designed to evaluate the effectiveness of adjunct instructional materials, when used under unstructured conditions outside the classroom. Adjunct instructional materials are questions and answers keyed to a text. The adjuncts for the study were prepared for textbooks used with two Air Force ROTC courses. Over 400 students at two universities served as subjects. Four experiments were conducted using a counterbalanced repeated measures design. Students used adjunct materials for portions of the text and served as a control for other portions of the text. The results indicate that adjunct materials promote learning of materials directly covered by adjunct questions, but do not contribute to application of the material covered by adjunct questions. The use of adjunct instructional materials is recommended. Further research, especially concerning the effects of various types of questions, also is recommended. (36 pp.)

450 **Cream, B.W., & Woodruff, K.R. Functional integrated systems trainer: description and evaluation. AFHRL-TR-75-6(I). Wright-Patterson AFB, OH: Advanced Systems Division, December 1975. Project ILIR, Contract F33615-73-C-4134, Systems Research Laboratories, Inc. NTIS.** In response to a request from the Tactical Air Command, a set of four integrated trainers and an operator/instructor console was developed and evaluated. The integrated trainers provide for the learning and practice of individual and crew coordination tasks of the four crew members of the AC-130H "Gunship." The crew members include the Forward Looking Infrared Sensor (FLIR) operator, the Low Light Level TV (LLLTV) operator, the Black Crow Electronic Warfare operator (BC/EWO), and the Fire Control Officer (FCO).

Four factors were especially emphasized in the development of the set of four trainers. One was to base the entire design on a detailed task analysis of the precise duties of each crew member. The second was to give special attention to tasks requiring crew coordination. The third was to provide only the minimum degree of functional simulation to support effective transfer to performance under operational conditions. The final factor was to develop the device at the lowest possible cost.

The trainers were installed, evaluated and used for further operational training at the 415th Special Operations Training Squadron, Hurlburt Field, Florida. Both trainees and instructors commented very favorably on the trainers. Experimental data indicate that trainees who used the devices achieved a higher level of performance during realistic airborne operations much earlier than did trainees who did not use the device.

The total program was conducted in a manner to facilitate further utilization of the technology being used in the program. This aspect of the program was successful.

451 **Cream, B.W., & Lambertson, D.C. Functional integrated systems trainer: technical design and operation. AFHRL-TR-75-6(II), AD-A015 835. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Project ILIR, Contract F33615-73-C-4134, Systems Research Laboratories, Inc. NTIS.** A functional integrated systems trainer was designed and constructed for training four members of the Gunship AC-130E/H crew in their individual and crew coordination tasks. The design was based on the behavioral task analysis conducted by the Tactical Air Command (TAC) instructional systems development team and further refined by Air Force Human Resources Laboratory. The trainer is installed and currently being used by TAC. An extensive evaluation was conducted which focused on the actual training value of the device. The findings showed that it provided effective training, validated the design concepts/techniques, and the cost effectiveness of functional, low cost part task trainers. It also provided significant additional information pertaining to the design and utilization of such devices and their applications to other systems. This report provides a detailed description of the construction and operation of the device. (60 pp.)

452 **Wiley, L.N. Familiarity with subordinates' jobs: immediate versus secondary supervisors. AFHRL-TR-75-7, AD-A015 758. Lackland AFB, TX: Occupational and Manpower Research Division, June 1975. Project 7734. NTIS.** A test was made of the hypothesis that only immediate supervisors know enough about their subordinates' job activities to render job performance ratings. Pairs of supervisors who rated the quality of performance of Supply airmen had identified themselves as immediate supervisors and other-than-immediate supervisors. These pairs, working independently, rated the same airmen on how well they performed individual tasks. Each supervisor was asked to rate each task that he was sure the subordinate did, but he was not told which tasks the subordinate had identified. The selections of tasks were tallied against the responses made by the incumbents on the same inventory. An incumbent's responses were relative time spent ratings. Tasks were classified by a scale of percent time spent, and two supervisory levels were compared in terms of percentage of tallies ("agreements") with the incumbents. The tallies were greater for tasks on which the airmen spent more time, but there was no detectable difference between immediate and other supervisors. It was concluded that in the Inventory Management, DAFSC 645X0, and Materiel Facilities, DAFSC 647X0, career ladders, at least, it was possible to obtain other supervisors who were as familiar with their subordinates' jobs as "immediate" supervisors. (22 pp.)

453 **Eddowes, E.E., & King, N.W. Self-perceived problems of student pilots eliminated from undergraduate pilot training. AFHRL-TR-75-8, AD-A016 417. Williams AFB, AZ: Flying Training Division, July 1975. Project 1123. NTIS.** This report describes how students eliminated from undergraduate pilot training (UPT) perceived the circumstances leading to their elimination. The objectives of the study were: increased understanding of factors associated with UPT attrition and delineation of prime areas for training research. Personal interviews with 117 eliminees provided information on the similarities and differences among five categories of attrition: Self-initiated elimination (SIE), manifestation of apprehension (MOA), flying deficiency (FD), medical deficiency (MD) and academic deficiency (ACAD). While major problem areas were identified related to learning how to land the aircraft and with student-instructor pilot interactions, inability to acquire pilot skills is not as important a basis for elimination from UPT as are other categories of elimination, such as SIE and MOA, both of which are associated with a variety of psychological attributes. It was concluded that

eliminees' perceptions of training problem areas can provide useful information for training program management and can suggest areas for training research. (28 pp.)

454 **Askren, W.B., & Korkan, K.D. Design option decision tree: a method for systematic analysis of design problems and integration of human factors data. AFHRL-TR-75-9, AD-A016 418. Wright-Patterson AFB, OH: Advanced Systems Division, July 1975. Project 1124. NTIS.** A graphical format termed the Design Option Decision Tree (DODT) is described. The DODT displays the various design options available at each decision point in the design process. Several examples of DODTs for aircraft design problems are illustrated. The procedures for developing a DODT are described. A proposed method for use of the DODT to resolve a design problem is presented. This method includes evaluating the design options in the Tree for impact on the system, and tracing paths through the Tree as dictated by specific design goals. The use of human factors data as one of the evaluation parameters is described. The paper concludes with a discussion of other uses of a DODT. (22 pp.)

455 **Wood, M.T., Hakel, M.D., DelGaizo, E.R., & Klimoski, R.J. Identification and analysis of social incentives in Air Force technical training. AFHRL-TR-75-10, AD-A017 871. Lowry AFB, CO: Technical Training Division, October 1975. Project 1121, Contract F41609-72-C-0044, Ohio State University. NTIS.** This report describes the procedures followed in identifying and analyzing social incentives which might be used in Air Force technical training. Questionnaire techniques were used to scale potential incentives for attractiveness, feasibility and other characteristics. Personal motives, background variables, and leadership climate factors were found to be related to attractiveness ratings. Six social incentives from the original list were redesignated as social behaviors which should be encouraged in training environments to enhance performance. On the basis of the questionnaire and administrative assessments of feasibility data, 18 additional incentives (both social and non-social) were proposed for use in a field experimental situation. (142 pp.)

456 **Hakel, M.D., Klimoski, R.J., & Wood, M.T. Management of social incentives in Air Force technical training: a field experiment. AFHRL-TR-75-11, AD-A016 727. Lowry AFB, CO: Technical Training Division, September 1975. Project 1121, Contract F41609-72-C-0044, The Ohio State University, Research Foundation. NTIS.** This report presents the rationale, design, and results of a field experiment which explored the use of social incentives in Air Force technical training. Four experimental treatments of varying complexity were introduced sequentially into a resident training avionics course. These treatments attempted to increase the incidence of student leadership behaviors on the assumption that social interaction would be reinforcing and lead to improved performance. Dependent variables included block exam scores, time to complete blocks, and student attitudes. Results showed that none of the experimental systems had an appreciable effect on performance. One system, however, did have a significant positive effect on student attitudes toward fellow trainees. Various alternative explanations are proposed along with suggestions for future research. (184 pp.)

457 **Lebkisher, H.E. Annotated bibliography of the Advanced Systems Division reports (1973–1974). AFHRL-TR-75-12, AD-A016 419. Wright-Patterson AFB, OH: Advanced Systems Division, August 1975. Project 1710. NTIS.** This bibliography presents an unclassified, unlimited, annotated bibliography of technical reports and other publications on research conducted by the Advanced Systems Division, Air Force Human Resources Laboratory (AFHRL). The cited references cover the period March 1973 through December 1974. Also included are references of reports published prior to March 1973 which were approved for public release during this period. This report supplements Annotated Bibliography of the Advanced Systems Division Reports (1950–1972), AFHRL-TR-72-43, March 1973, AD-760 114.

The reports listed in this annotated bibliography are not obtainable from the Air Force Human Resources Laboratory. Except for journal articles, microfiche and reproduced paper copies may be purchased from the National Technical Information Service (NTIS), Springfield, Virginia 22161.

When reports are ordered from either DDC or NTIS, use the accession number which appears at the end of the bibliographic reference. Some recent reports are included which had not been assigned accession numbers prior to publication of this bibliography. To obtain copies of reports without DDC accession numbers, you must furnish the names of authors, titles, report numbers, and dates to DDC or NTIS. (42 pp.)

458 **McGuirk, F.D., Pieper, W.J., & Miller, G.G. Operational tryout of a general purpose simulator. AFHRL-TR-75-13, AD-A014 794. Lowry AFB, CO: Technical Training Division, May 1975. Project 1121, Contract F41609-73-C-0029, Applied Science Associates, Inc. NTIS.** The operational effectiveness of a general purpose simulator (GPS) was evaluated in a technical training course. GPS, in this context, refers to a computer based, programmable device that can be rather easily modified with varying levels of fidelity. A simulation model was designed for use in instructing students in checkout and troubleshooting procedures for a sophisticated aircraft radar system. Evaluation results clearly showed that the simulator was an effective training device: (a) training was at least as adequate as training received on an actual equipment trainer (AET) used in the course, (b) the simulator was much less expensive and more reliable than the AET, and (c) the simulator had the additional capability of training troubleshooting tasks. (52 pp.)

459 **Pieper, W.J., & Benson, P.G. Simulation design manual for the EC-II simulator. AFHRL-TR-75-14, AD-A014 798. Lowry AFB, CO: Technical Training Division, May 1975. Project 1121, Contract F41609-73-C-0029, Applied Science Associates, Inc. NTIS.** This report can be used as an aid for developing simulation models (faceplate, slide disc visuals, and programs) for the EC-II programmable simulator. Guidance is provided for the design of the basic instructional program, including collection and organization of materials/information used to develop the models. Explanations are also provided for obtaining panel design data, developing program information, and developing program logic expressions. (50 pp.)

460 **Earles, J.A., Mullins, C.J., Abellera, J.W., & Michelson, A.E. Drug use data base. AFHRL-TR-75-15, AD-A017 169. Lackland AFB, TX: Personnel Research Division, July 1975. Project 7719. NTIS.** A data base of various drug use variables has been created on a broad sample of 13,452 Air Force service men, officers as well as enlisted men. While lack of resources prevents a detailed analysis of information in the data base, certain trends are evident. Alcohol is consumed by most Air Force personnel, but current use of illicit drugs is confined to a small percentage. In addition, users of illicit drugs are predominately in the first term enlisted ranks. Finally, more than one-third of the users of illicit drugs claim they usually buy their drugs on Air Force bases. (14 pp.)

461 **Weeks, J.L., & Mullins, C.J. Prediction of drug abuse by the social factors questionnaire. AFHRL-TR-75-16, AD-A017 170. Lackland AFB, TX: Personnel Research Division, July 1975. Project 7719. NTIS.** Two measures, the lawlessness and permissiveness scores, yielded by a locally developed experimental psychological test were investigated to determine if they added significantly to the prediction of seven drug abuse criteria when combined with available demographic and aptitude variables. The results indicate that both scores add significant predictive variance to the background variables and appear to have considerable success in discriminating between drug abusers and nonabusers. (18 pp.)

462 **Alley, W.E., & Berberich, G.L. An analysis of AFROTC detachment viability. AFHRL-TR-75-18, AD-A017 797. Lackland AFB, TX: Personnel Research Division, August 1975. Project 7719. NTIS.** This report is one of a series describing: (a) the development of effectiveness criteria for AFROTC detachments, and (b) relationships between the criteria and various environmental and program characteristics. Normative data are presented for selected criteria (enrollment, production and unit costs) for each school year between 1966 and 1974. Multiple

regression techniques were used to determine the extent to which criterion performance was attributable to characteristics of the host college and characteristics of the program. Predictive stability was examined across both institutions and time. Implications of the findings for evaluating both current detachments and potential host sites were discussed. (24 pp.)

463 **Brown, J.E., & Rust, S.K. Undergraduate pilot training task frequency study. AFHRL-TR-75-19, AD-A017 472. Williams AFB, AZ: Flying Training Division, August 1975. Project 1123. NTIS.** The objectives of this project were to determine the number of training task repetitions required for a UPT student to become proficient in each UPT task, and to determine the total number of task repetitions that UPT students receive for each maneuver in T-37 and T-38 training. This report describes the results of two studies. Study I shows the development of data collection procedures which could be used in an operational UPT program and the initial application of these procedures at Williams AFB, Arizona. Study II describes the operational implementation of improved data collection procedures at Craig AFB, Alabama. Computer programs were used to analyze the data to provide the following descriptive statistics for each task in a specified training phase: mean, standard deviations, medians, modes, and ranges (maximum and minimum values). The results should be useful to the Air Training Command for UPT syllabus development. (60 pp.)

464 **Kirby, P.J., Gardner, E.M., & McKnight, L.R. Design of a computer-controlled, random-access slide projector interface. AFHRL-TR-75-20, AD-A016 726. Lowry AFB, CO: Technical Training Division, August 1975. Project 1121. NTIS.** The Technical Training Division of the Air Force Human Resources Laboratory has a research and development mission to improve Air Force training through the application of instructional and computer technology in the administration and management of individualized instruction. Within this new pedagogic environment, a computer-controlled random-access image projection capability is desired. This is a report on the successful design, development, test and evaluation of an electronic hardware device interfacing a commercially available slide projector with a plasma panel computer terminal. The interface device allows an instructional computer program to select slides for viewing based upon the lesson/student situation parameters of the instructional strategy employed. (24 pp.)

465 **Beusse, W.E. Factors related to the incidence of disciplinary actions among enlisted personnel. AFHRL-TR-75-21.Alexandria, VA: Manpower and Personnel Systems Division, April 1975. Project 4499. NTIS.** The purpose of the study was to examine the disciplinary rates of various subgroups of the enlisted population and the attitudes of officers and enlisted personnel towards the military justice system. A fairly clear picture emerged of the serviceman who is prone, to encounter disciplinary problems. Such an individual is likely to be young, in his first term, low ranking, single, relatively uneducated, and serving in a relatively low skilled military occupation. The tiered severity of the military justice system appeared to be working satisfactorily. In general, a great deal of unfamiliarity with the military justice system was found among both officers and enlisted personnel. Officers were found to judge disciplinary actions as reasonable and fair while enlisted personnel were more likely to see them as being too strict. (18 pp.)

466 **Mayo, C.C., Nance, D.M., & Shigekawa, L. Evaluation of the job inventory approach in analyzing USAF officer utilization fields. AFHRL-TR-75-22, AD-A014 800. Lackland AFB, TX: Occupational and Manpower Research Division, June 1975. Project 7734, Contract F41609-72-C-0040, Lifson, Wilson, Ferguson and Winick, Inc. NTIS.** The purpose of the study was to evaluate and improve the job inventory method of job analysis as applied to officer positions. Seven utilization fields were analyzed and inventories were constructed for another three fields. The basic finding was that the inventory method can be used operationally in the analysis of officer jobs if job analysts use specific approaches to task statement construction and if more front-end research than is usually needed for airman job inventories is performed prior to the finalization of a job inventory. No magic formulae for the construction of task statements exist; however, after heavy front-end work,

the job analyst will obtain enough information to enable him to resolve the issues of task specificity and breadth of coverage for each utilization field on an individual basis. (86 pp.)

467 **Stacy, W.J., & Hazel, J.T. A method of determining desirable task experiences for first-line supervisors. AFHRL-TR-75-23, AD-A017 471. Lackland AFB, TX: Occupational and Manpower Research Division, August 1975. Project 7734. NTIS.** Accounting and finance supervisors rated journeyman-level tasks on the importance of a supervisor knowing how to perform those tasks for being a satisfactory supervisor. There were 254 desirable journeyman-level tasks identified in the study. Job analyses of career work experiences for 1,261 accounting and finance supervisors indicated that many supervisors had limited career experience in the desirable journeyman-level tasks. Further, many of the supervisors had spent most of their career time within very few of eight accounting and finance work areas. This study indicates the present accounting and finance work management unit may be too broad for the required work activities. Interviews with accounting and finance personnel supported the findings of this study with regard to the problem of supervisory work experience. Separation of the Accounting (671X1) and Disbursement (671X3) career ladders through the 7-skill level appeared preferable. (24 pp.)

468 **Monroe, E.G. Environmental data base development process for the ASUPT CIG system. AFHRL-TR-75-24, AD-A017 845. Williams AFB, AZ: Flying Training Division, August 1975. Project 1192, Contract F33615-72-C-1717, General Electric Company. NTIS.** This report was prepared under the assumption that the reader has a general understanding of the Advanced Simulator for Undergraduate Pilot Training (ASUPT) Computer Image Generation (CIG) System, at least to the level of that presented in the technical report, Advanced Simulation in Undergraduate Pilot Training (ASUPT) Facility Utilization Plan, AFHRL-TR-74-43, June 1974.

Modeling for CIG may be thought of as a new art form in which the features to be modeled are approximated by sets of straight line segments forming planar faces to which a shade of gray is assigned. Basically the data base is structured in the sequence edge, face, object, model, and environment, each item composed of a set of the items immediately preceding it in the sequence. The detailed definition of each item is transferred from the coding forms prepared by the modeler to computer input cards. These cards serve as the computer source input. The offline software algorithms perform validation checks on this input. Error messages are related through the teletype and line printer. Valid data is stored as libraries of objects, models and environments on magnetic tapes, and the appropriate environment is restored on disc by a media conversion from tape to disc. (68 pp.)

469 **Pina, M. Training line simulator (enhanced version) revised user's manual. AFHRL-TR-75-25, AD-A015 754. Lackland AFB, TX: Occupational and Manpower Research Division, June 1975. Project 2077. NTIS.** The training line simulator (TLS) was reprogrammed to run on the AFHRL UNIVAC 1108. This revised user's manual partially documents this effort by providing an updated manual for prospective users of TLS.

The training line simulator was designed as a managerial aid for investigating and evaluating the various and diverse policy interactions which impact on basic military training and entry-level technical training courses. This user's manual provides user-oriented documentation in sufficient detail to give the prospective user a complete grasp of the concepts and logic underlying the model. The manual is divided into three chapters: (1) description of system functions, (2) description of system modules, and (3) user instructions. (180 pp.)

470 **Matheny, W.G., Gray, T.H., & Waters, B.K. AFHRL/FT capabilities in undergraduate pilot training simulation research: executive summary. AFHRL-TR-75-26(I), AD-A017 168. Williams AFB, AZ: Flying Training Division, August 1975. Project 1123, Contract F41609-73-C-0038, Life Sciences, Inc. NTIS.** This report presents an executive summary of a contractual effort by Life Sciences, Inc. It

describes: (1) the research capabilities of AFHRL/FT, with particular emphasis upon the advanced simulator for undergraduate pilot training (ASUPT), (2) results of a prioritization of potential flying research issues by a panel of experts, (3) contractor recommendations for intitial AFHRL/FT experimental investigations, and (4) the AFHRL/FT facility utilization program for calendar year 1975.

The concept of "performance equivalence" between simulator and aircraft is presented along with a description of suggested studies designed to validate the concept. Utilization of automated performance measures on both system outputs and pilot control inputs forms an essential element of the model. (32 pp.)

471 **Matheny, W.G. Training research program and plans: advanced simulation in undergraduate pilot training. AFHRL-TR-75-26(II), AD-A016 486. Williams AFB, AZ: Flying Training Division, June 1975. Project 1123, Contract F41609-73-C-0038, Life Sciences, Inc. NTIS.** In this study, a survey was made among experts in pilot training to determine the important training research problems to be undertaken in order to increase training effectiveness in beginning pilot training. The highest priority problems were examined in the light of the research equipment capabilities of the Air Force Human Resources Laboratory, Flying Training Division, and administrative constraints. The initial experiments in the area of training methodology and training simulator requirements are recommended and outlined. The performance equivalence approach to research in these areas is described.

Studies are suggested designed to evaluate the concept and its use in training research. (102 pp.)

472 **Waters, B.K. Empirical investigation of the stradaptive testing model for the measurement of human ability. AFHRL-TR-75-27, AD-A018 611. Williams AFB, AZ: Flying Training Division, October 1975. Project 1121. NTIS.** This study empirically investigated the validity and utility of the stratified adaptive computerized testing model (stradaptive) developed by Weiss (1973). The model presents a tailored testing strategy based upon Binet IQ measurement theory and Lord's (1972) modern test theory.

Nationally normed School and College Ability Test Verbal analogy items (SCAT-V) were used to construct an item pool. Item difficulty and discrimination indices were rescaled to normal ogive parameters on 249 items.

One hundred and three freshmen volunteers at Florida State University were randomly assigned to stradaptive or conventional test groups. Both groups were tested via cathode-ray-tube (CRT) terminals coupled to a Control Data Corporation 6500 computer.

The conventional subjects took a SCAT-V test essentially as published, while the stradaptive group took individually tailored tests drawn from the same item pool.

Results showed significantly higher reliability for the stradaptive group, and equivalent validity indices between stradaptive and conventional groups. Both KR-20 and parallel-forms reliabilities were computed for the stradaptive group.

Three stradaptive testing strategies averaged 19.2, 26.5 and 31.5 items per subject as compared with 48.4 items per conventional subject. A 50% reduction from conventional test length produced an equal precision of measurement for stradaptive subjects.

Item latency comparisons showed the stradaptive group required significantly longer per item (about 11%) than conventional group members. The author recommended that time rather than number of items be used in future adaptive research as a dependent variable.

Further investigation of the stradaptive model was recommended with comparisons between variable and fixed test termination rules. (70 pp.)

473 **Shriver, E.L., & Foley, J.P., Jr. Job performance aids for UH-1H helicopter: controlled field tryout and evaluation. AFHRL-TR-75-28(I), AD-B006 595L. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Projects 1127, and 1710, Contracts F33615-71-C-1638 and F33615-70-C-1550, URS/Matrix Research Company. DDC.** Three types of Job Performance Aids (JPA) were developed for the UH-1H helicopter: (1) Fully Proceduralized Job Performance Aids (FPJPA) for non-troubleshooting tasks (sometimes called Job Guide Manuals), (2) FPJPA for troubleshooting tasks (sometimes called Fully Proceduralized Troubleshooting Aids – FPTSA), and (3) partially proceduralized JPA for troubleshooting based on Maintenance Dependency Charts (MDC). The effectiveness of these JPA were evaluated against the conventional Technical Manuals (TM) normally used to support maintenance. Eleven job task performance tests were administered to 54 experienced, apprentice, and novice (no training or experience) USAF helicopter technicians and 36 experienced and apprentice Vietnamese Air Force helicopter mechanics. Each subject performed checkout; align and adjust; remove and replace, and service tasks. Half of these non-troubleshooting tasks were performed using FPJPA (Job guide Manuals) and half using the TM. Each subject performed one troubleshooting task using the FPJPA, another task using the MDC and a third task using the TM. Preliminary adminstration of the performance tests revealed that the FPJPA (for both non-troubleshooting and troubleshooting tasks) contained too many errors to permit successful completion of the tasks. To make the evaluation possible, the technical errors were corrected. Early administrations of these revised aids to the USAF subjects revealed that their use did not result in the desired level of performance. Therefore, two additional revisions were made. The revisions were based on a reanalysis of the tasks. The number of American subjects who performed the tasks using each revision was too small for a statistical analysis. However, as each new revision was implemented, a noticeable improvement in performance was made. Vietnamese subjects used the second revision only. The tests revealed that they were able to perform the tasks successfully using the FPJPA. Six additional FPJPA for non-troubleshooting tasks were evaluated in Vietnam, indicating the same pattern of technical errors. Several tasks were repeated 10 times by the same subjects using the FPJPA indicating that FPJPA improves the performance of novice and apprentice subjects and quickly overcomes differences in initial experience levels. The results of the evaluation emphasize the importance of conducting a thorough behavioral analysis of identified tasks followed by hands on validation/verification in the development of JPA. A description of this type of analysis is given in AFHRL-TR-75-38. (108 pp.)

474 **Foley, J.P., Jr. Job performance aids for UH-1H helicopter: typical fully proceduralized aids for non-troubleshooting tasks. AFHRL-TR-75-28(II), AD-B006 596L. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Project 1710. DDC.** As part of the Vietnamization program, three types of job performance aids (JPA) were developed for the UH-1H helicopter: (1) fully proceduralized job performance aids (FPJPA) for non-troubleshooting tasks (sometimes called job guide manuals), (2) FPJPA for troubleshooting tasks (sometimes called fully proceduralized troubleshooting aids – FPTSA), (3) partially proceduralized JPA based on maintenance dependency charts (MDC). The effectiveness of these JPA were evaluated against the conventional technical manuals (TM) normally used to support maintenance. The results of this evaluation are reported in Volume I. As part of this evaluation, eleven job task performance tests were administered. Eight of the eleven tasks tested were of the non-troubleshooting variety and three tasks were of the troubleshooting variety. A large part of Volume I is concerned with a discussion of the FPJPA for these eleven tasks. In order to make these discussions more meaningful for the readers of Volume I, the FPJPA for these eleven tasks are being made available in Volumes II and III. Volume II contains the FPJPA for the eight non-troubleshooting tasks; Volume III, the FPJPA for the three troubleshooting tasks. These FPJPA Volumes also provide a DDC source of typical samples of FPJPA in a two-language format. (276 pp.)

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475 **Foley, J.P., Jr. Job performance aids for UH-1H helicopter: typical fully proceduralized aids for troubleshooting tasks. AFHRL-TR-75-28(III), AD-B006 627L. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Project 1710. DDC.** As part of the Vietnamization program, three types of job performance aids (JPA) were developed for the UH-1H helicopter: (1) fully proceduralized job performance aids (FPJPA) for non-troubleshooting tasks (sometimes called job guide manuals), (2) FPJPA for troubleshooting tasks (sometimes called fully proceduralized troubleshooting aids – FPTSA), (3) partially proceduralized JPA based on maintenance dependency charts (MDC). The effectiveness of these JPA were evaluated against the conventional technical manuals (TM) normally used to support maintenance. The results of this evaluation are reported in Volume I. As part of this evaluation, eleven job task performance tests were administered. Eight of the eleven tasks tested were of the non-troubleshooting variety and three tasks were of the troubleshooting variety. A large part of Volume I is concerned with a discussion of the FPJPA for these eleven tasks. In order to make these discussions more meaningful for the readers of Volume I, the FPJPA for these eleven tasks are being made available in Volumes II and III. Volume II contains the FPJPA for the eight non-troubleshooting tasks; Volume III, the FPJPA for the three troubleshooting tasks. These FPJPA Volumes also provide a DDC source of typical samples of FPJPA in a two-language format. (378 pp.)

476 **Potter, N.R., Korkan, K.D., & Dieterly, D.L. Development, application, and evaluation of a procedure for quantification of technological change impact on human resources. AFHRL-TR-75-29(I), AD-A014 332. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Project 7907, Contract F33615-74-C-4019, Systems Research Laboratories, Inc. NTIS.** A multiphased study effort was conducted to lead to the development of methods for determining the components and measuring the effects of advances in technology on human resources in Air Force weapon systems. A first phase of the effort involved the conduct of an analysis of the literature to review the status of forecasting and assessing technology and of techniques for predicting the impact of technology on human resources parameters (AFHRL-TR-74-71). The second phase involved the development of Design Option Decision Trees (DODT) for two areas of Air Force systems technology: Digital Avionics Information System (DAIS) and Remotely Piloted Vehicle Systems (RPV). The third phase called for the development of unique methods or synthesis of existing techniques to result in a new method for measuring the effects of technology on Air Force human resources. The fourth phase involved application of the method developed under phase three. The fifth and last phase entailed making an evaluation of the usefulness of the method to system designers and planners. A method integrating the DODT with a modification of the method of summated ratings was developed to arrive at a quantification of human resource effects of technological innovations. This procedure was applied (AFHRL-TR-75-33) to the DODT to provide the source data for the evaluation of the developed method. The DODTs for DAIS are presented in Volume II of this report and the DODTs for RPV are presented in Volume III. (48 pp.)

477 **Potter, N.R., Korkan, K.D., & Dieterly, D.L. Digital avionics information system design option decision trees. AFHRL-TR-75-29(II), AD-A014 333. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Project 7907, Contract F33615-74-C-4019, Systems Research Laboratories, Inc. NTIS.** A multiphased study effort was conducted to lead to the development of methods for determining the components and measuring the effects of advances in technology on human resources in Air Force weapon systems. A first phase of the effort involved the conduct of an analysis of the literature to review the status of forecasting and assessing technology and of techniques for predicting the impact of technology on human resource parameters (AFHRL-TR-74-71). The second phase involved the development of Design Option Decision Trees (DODT) for two areas of Air Force systems technology (Digital Avionics Information System and Remotely Piloted Vehicle System). The third phase called for the development of unique methods or synthesis of existing techniques to result in a new method for measuring the effects of technology on Air Force human resources. The fourth phase involved application of the method developed under phase three. The fifth and last

phase entailed making an evaluation of the usefulness of the method to system designers and planners. A method integrating the DODT with a modification of the method of summated ratings was developed to arrive at a quantification of human resource effects of technological innovations. This procedure was applied to the Digital Avionics Information System DODT to provide the source data for the evaluation of the developed method. The DODTs for the DAIS are presented in this volume. (40 pp.)

478 **Potter, N.R., Korkan, K.D., & Dieterly, D.L. Remotely piloted vehicles design option decision trees. AFHRL-TR-75-29(III), AD-A018 152. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Project 7907, Contract F33615-74-C-4019, Systems Research Laboratories, Inc. NTIS.** A multiphased study effort was conducted to lead to the development of methods for determining the components and measuring the effects of advances in technology on human resources in Air Force weapon systems. A first phase of the effort involved the conduct of an analysis of the literature to review the status of forecasting and assessing technology and of techniques for predicting the impact of technology on human resource parameters (AFHRL-TR-74-71). The second phase involved the development of Design Option Decision Trees (DODT) for two areas of Air Force systems technology (Digital Avionics Information System and Remotely Piloted Vehicle Systems). The third phase called for the development of unique methods or synthesis of existing techniques to result in a new method for measuring the effects of technology on Air Force human resources. The fourth phase involved application of the method developed under phase three. The fifth and last phase entailed making an evaluation of the usefulness of the method to system designers and planners.

A method integrating the DODT with a modification of the method of summated ratings was developed to arrive at a quantification of human resource effects of technological innovations. This procedure was applied to the Digital Avionics Information System DODT to provide source data for the evaluation of the developed method. The DODTs developed for the RPV system are presented in this volume. (54 pp.)

479 **Guinn, N., Johnson, A.L., & Kantor, J.E. Screening for adaptability to military service. AFHRL-TR-75-30, AD-A014 790. Lackland AFB, TX: Personnel Research Division, May 1975. Project 7719. NTIS.** A sample of 15,252 basic airmen was administered the history opinion inventory (HOI) during basic military training. The service careers of these subjects were monitored for two years in order to assess the ability of the HOI to predict the criterion of in/out of service. An *a priori* adaptation index developed from HOI items correctly identified as high risk 23 percent of those subjects discharged from service during the two year period, while incorrectly labeling as high risk only 6 percent of those subjects still in service after two years. The possibility of increasing the accuracy of prediction by utilizing biographic/demographic data and the operational usefulness of the HOI is discussed. (32 pp.)

480 **Hazel, J.T., & Carpenter, J.B. Procedure for determining grades of officer positions. AFHRL-TR-75-31, AD-A015 755. Lackland AFB, TX: Occupational and Manpower Research Division, July 1975. Project 7734. NTIS.** This report describes a procedure for determining appropriate grades for officer jobs. The method involves application of a nine-variable equation for computing a composite score and use of a conversion table for translating this score into a specific grade level, lieutenant through colonel. An explanation and illustration of the seven steps in the method are provided as follows:

(1) preparation and review of a job description, (2) obtaining five factor ratings, (3) obtaining grade ratings, (4) derivation of organization level variable values, (5) derivation of supervisor's judged-grade value, (6) computation of an integer-weighted composite score, and (7) conversion of the composite score to an equivalent officer grade. (26 pp.)

481 **Phalen, W.J. Comprehensive occupational data analysis programs (CODAP): ordering of hierarchically grouped case data (KPATH) and print KPATH (PRKPTH) programs. AFHRL-TR-75-32, AD-A016 724. Lackland AFB, TX: Occupational and Manpower Research Division, August 1975. Project 7734. NTIS.** This is one in a series of reports written to acquaint occupational analysts, occupational research personnel, and personnel managers with the functions and utilities of a set of Comprehensive Occupational Data Analysis Programs (CODAP). This technical report describes and gives examples of applications of the Ordering of Hierarchically Grouped Case Data (KPATH) and Print KPATH (PRKPTH) programs. These programs greatly facilitate the identification of background variables having similar values for all or most cases in any hierarchical group. Because of the highly technical nature of this report, it will be of interest only to readers who have a need to understand how the CODAP KPATH and PRKPTH programs function. (30 pp.)

482 **Potter, N.R., Korkan, K.D., & Dieterly, D.L. A procedure for quantification of technological changes on human resources. AFHRL-TR-75-33, AD-A014 335. Wright-Patterson AFB, OH; Advanced Systems Division, June 1975. Project 7907, Contract F33615-74-C-4019, Systems Research Laboratories, Inc. NTIS.** A long standing research objective of the human factors psychologist has been the capability to predict the human resource requirements of new equipment. An even more intriguing problem is the prediction of human resource requirements based on the introduction of a new technology. The purpose of this study was to locate and apply an existing method, or to develop a new procedure for quantifying the effects of incoming technology. A five-step approach was taken in an attempt to achieve the research goal. These steps included search and critical analysis of the recent literature to review the status of forecasting and assessing technology, and of techniques for predicting the impact of technology on human resources; development of Design Option Decision Trees (DODT) describing two Air Force systems; synthesis of existing techniques to develop a procedure for measuring the effects of technology on human resources; application of the procedure; and evaluation of the feasibility of the evolved procedure.

A procedure integrating the DODT with a modification of the method of summated ratings was developed to permit quantification of specific human resource components at each of the design options represented in the DODT. Using judgmental data collected from an Air Force operational unit, the method developed under this study effort was evaluated. It was concluded that quantifying human resource components associated with hardware design options by means of a technique incorporating a DODT and a modification of the method of summated ratings was a feasible approach and could provide one methodological procedure for measuring the effects of advances in technology on human resources. (90 pp.)

483 **Pruitt, G.K., & Dieterly, D.L. Digital avionics information system preliminary life-cycle-cost analysis. AFHRL-TR-75-34, AD-A017 166. Wright-Patterson AFB, OH: Advanced Systems Division, September 1975. Project 2051, Contract F09603-74-A-0844-SG01, ARINC Research Corporation. NTIS.** A mathematical model was developed and exercised to evaluate the life-cycle costs of avionics developed according to the Digital Avionics Information System (DAIS) approach. The objective was to provide an initial estimate, based on available data, of the costs and cost savings associated with the DAIS concept. A comparative analysis was performed to estimate the relative costs of the avionics of four different aircraft types for both conventional and DAIS configurations. The results of this analysis were intended only to provide a perspective of the relative costs of DAIS and conventional avionics systems; they do not necessarily represent the true costs that may be encountered in an operational environment.

The depth and accuracy of the estimates made in this report are necessarily restricted by the available data and the limited scope of the study. The DAIS costs are preliminary estimates or projections supplied by the DAIS Program Office at the Air Force Avionics Laboratory (AFAL). The data for the conventional avionics were extracted from many sources, including the Increase Reliability of Operational System (IROS) data system. Therefore, interpretation of the analyses

contained in this report should be restricted to an assessment of the relative cost of the avionics integration approaches that have been addressed.

Because of limitations on the availability of data, only a qualitative assessment of the effects of applying the DAIS concept could be made for the cost categories of research and development, installation, support equipment, training equipment, and technical documentation. (76 pp.)

484 **Bunker, M., & Heeschen, R. Airborne electro-optical sensor simulation. AFHRL-TR-75-35, AD-A016 725. Wright-Patterson AFB, OH: Advanced Systems Division, July 1975. Project ILIR, Contract F33615-74-C-5161, General Electric Company. NTIS.** Cost effective training of personnel in operation of infrared (IR) and low light level television (LLLTV) systems requires the development of real-time ground based equipment for simulating the performance characteristics of such systems. Such hardware must be carefully specified to provide the essential degree of validity in simulation of performance and detail of visual cues.

The major effort covered in this report has been the development of an extremely versatile and unconstrained software simulation model. In such a system, increasing the complexity of scenes and of modelling computation incurs no increase in cost, but they are accommodated by allowing increased processing time. With essentially unconstrained scene detail capability, transfer function definition, tonal assignment capability, noise simulation characteristics, and atmospheric effects simulation, the model can readily be adjusted to simulate the characteristics of actual systems, present or future. It can further be set up to show the precise effect of simulation hardware specifications differing from actual equipment, to meet the goal of precise hardware specification.

In a previous program, Airborne Electro-Optical Sensor Simulation Phase I, scenes were photographed from actual sensor systems flying missions at three target areas near Eglin AFB, Florida. Environment model data bases were prepared for these areas, and model characteristics were adjusted to match the actual scenes. The sensor characteristics were simulated, well within the capability of the model.

Finally, the system was delivered and set up to run on the Air Force Sigma 5 installation, as a tool for further research. This included complete software for modification or generation of completely new environment data bases. (108 pp.)

485 **Christal, R.E. Systematic method for establishing Officer Grade Requirements based upon job demands. AFHRL-TR-75-36, AD-A015 756. Lackland AFB, TX: Occupational and Manpower Research Division, July 1975. Project 7734. NTIS.** This report presents interim results of a study developing a methodology for management engineering teams to determine the appropriate grade requirements for officer positions based upon job content and responsibilities. The technology reported represents a modification and extension of methods developed between 1963 and 1966. Results indicated that Manpower and Management Engineering personnel can accurately apply the Officer Grade Requirements (OGR) determination procedure. Recommendations are made for operational implementation and for determining the total distribution of non-aircrew officer grade requirements. (42 pp.)

486 **Smith, E.A. Quality assurance of media devices and courseware. AFHRL-TR-75-37, AD-A018 867. Lowry AFB, CO: Technical Training Division, October 1975. Project 1121. NTIS.** The intent of this publication is to outline one quality assurance program that could be employed during the development of prenarrated sound/slide instructional packages. The characteristics described were selected to be both: (a) important to instruction and (b) capable of being measured objectively. These criteria were selected in order to develop a program that would be suitable for incorporation into contracts where a training program would be developed by a commercial agency and delivered to a USAF training base. It is recommended that the procedures also be incorporated into programs in which the instructional material is being developed in-house. Particular attention is paid to the essentiality of being able to update and revise the training programs. (30 pp.)

487 **Shriver, E.L. Fully proceduralized job performance aids: guidance for performing behavioral analyses of tasks. AFHRL-TR-75-38, AD-A015 059. Wright-Patterson AFB, OH: Advanced Systems Division, June 1975. Projects 1127 and 1710, Contract F33615-71-C-1638. URS/Matrix Research Company. NTIS.** The initial tryout of FPJPA, for the UH-1H helicopter, indicated that although they met all the format requirements for FPJPA, they did not produce the expected level of task performance when used by novice and apprentice Air Force maintenance personnel. The author hypothesized that the FPJPA did not contain all of the cues and directions necessary for the novice and apprentice personnel. In this report he describes a method for identifiying such cues and responses during a "hands on" tryout of the initially produced task steps. He calls this method the behavioral analyses of tasks (BAT). The application of this BAT to many tasks produced an "unfolding" effect from pictorial to pictorial. It also identified many important but unplanned cues in the troubleshooting routines. Its application to the eleven UH-1H tasks used for the evaluation raised the performance level of both novice and apprentice personnel. FPJPA of reasonable effectiveness will probably be developed with less rigorous "hands on" analyses of tasks than the BAT proposed in this report, provided the FPJPA so developed are followed by a "cut and try" process of improvement. The accomplishment of a BAT requires highly skilled and tedious work on the part of each task analyst and its use will probably be viewed by some as too expensive. But the author's experience indicates that its timely use in the FPJPA development cycle will be necessary for the consistent production of a quality product at a minimum cost. (46 pp.)

488 **Pritchard, R.D., Hollenback, J.H., & DeLeo, P.J. Development and evaluation of an objective technique to assess effort in training. AFHRL-TR-75-39, AD-A017 864. Lowry AFB, CO: Technical Training Division, October 1975. Project 1141, Contract F41609-74-C-0010, Institute for Organizational Behavior Research. NTIS.** This research explored the validation of a quantifiable, objective, and reliable method of measuring the amount of effort to be directly rewarded in incentive systems. A battery of relevant ability tests was given to a sample of Air Force trainees and to civilian subjects using a simulation of the course taught the Air Force trainees. Results showed that the simulation subjects were comparable to the Air Force subjects and that the ability test battery predicted performance equally well for both samples. The hard criterion of effort displayed wide variability, excellent reliability, and good construct validity. (50 pp.)

489 **Dansereau, D.F., Long, G.L., McDonald, B.A., & Actkinson, T.R. Learning strategy inventory development and assessment. AFHRL-TR-75-40, AD-A014 721. Lowry AFB, CO: Technical Training Division, June 1975. Project 1121, Contract F41609-74-C-0013, Texas Christian University. NTIS.** A learning strategy inventory composed of 201 multiple-choice items, based upon similar work and aspects suggested from a literature review, was developed. Correlational and factor analyses (based on approximately 200 students) were performed to provide a basis for identifying trainable learning strategies. Four phases of the learning process were identified and incorporated into a learning strategy training program (reported elsewhere). The learning strategy inventory provided an effective basis for strategy training development. In addition, the learning strategy inventory provides a significant first step in the development of a more general instrument for diagnosing learning strategy inadequacies in specific individuals. (110 pp.)

490 **Dansereau, D.F., Long, G.L., McDonald, B.A., Actkinson, T.R., Ellis, A.M., Collins, K., Williams, S., & Evans, S.H. Effective learning strategy training program: development and assessment. AFHRL-TR-75-41, AD-A014 722. Lowry AFB, CO: Technical Training Division, June 1975. Project 1121, Contract F41609-74-C-0013, Texas Christian University. NTIS.** Potentially effective and trainable learning strategies were identified by an analysis of a specially developed learning strategy inventory and a review of educational and psychological review literature. Four aspects of the learning process suggested the usefulness of special training. These were the identification of important or unfamiliar material, the applications of techniques for the comprehension and retention

of this information, the efficient retrieval of information and the skill in coping with distractions during the foregoing processes. A training program was developed for teaching selected specific strategies, including the three alternative comprehension/retention strategies of paraphrasing, question-answering, and the use of visual imagery, in such a way as to compare the three alternative connection techniques. The results indicated that minimal strategy training showed significant results in long term retention, although no reliable differences were found in immediate testing. Further refining of the techniques was recommended. An effective strategy training program suitable for implementation in technical training was created, modified, and assessed. (80 pp.)

491 **Brown, J.E., Mullen, J.T., & Rust, S.K. Undergraduate pilot training task maneuver times study. AFHRL-TR-75-42, AD-A017 844. Williams AFB, AZ: Flying Training Division, September 1975. Project 1123. NTIS.** The objective of this study was to determine the time required to perform selected undergraduate pilot training maneuvers in the T-37 and T-38 aircraft. This report describes the method of collecting data and the maneuvers selected for investigation. The data for each maneuver was analyzed to provide maximum and minimum values, means and standard deviations. Implications of the data for syllabus development are presented. (24 pp.)

492 **Bell, J.W., Bottlik, I.P., & Lucero, A.B. Simulation techniques for airborne electro-optical imaging systems. AFHRL-TR-75-43, AD-A020 090. Wright-Patterson AFB, OH: Advanced Systems Division, December 1975. Project ILIR, Contract F33615-74-C-4069, Technology Service Corporation. NTIS.** The purpose of this study was to develop a computer software package to simulate airborne electro-optical imagery systems in nonreal time. The results of the study include a computer program that can be used as a research tool in conjunction with a long-range program for the development of sensor simulator technology and a set of techniques, algorithms, and design guidelines to be used in developing an interactive real-time simulator system.

The study encompassed three main areas. These were data base generation, mathematical model formulation, and algorithm and software development. The simulation program is designed to simulate three target areas under many different weather (visibility and water vapor content) and daytime conditions.

The inputs to the program allow the operator to choose a flight profile. The program then creates and displays a set of representative pictures of the target in a simulated flyby. (150 pp.)

493 **Maginnis, E.B., Uchima, A., & Smith, C.E. Establishing aptitude requirements for Air Force jobs: historical review of aptitude levels and impact on the personnel system. AFHRL-TR-75-44(I), AD-A023 250. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 1137, Contract F41609-71-C-0033, System Development Corporation. NTIS.** This report is the first in a series of three. It presents a review of the military service aptitude batteries with some comparisons of minimum aptitude scores required for entry to military occupational areas. Changes in Air Force aptitude score minimums are traced and summarized. A systems analysis of estimated impacts of different aptitude levels for enlistment on elements of the personnel system leads to a statement of salient negative influences on promotion, performance, and job/service satisfaction. (32 pp.)

494 **Maginnis, E.B., Uchima, A., & Smith, C.E. Establishing aptitude requirements for Air Force jobs: some personnel system actions to offset negative impacts of aptitude changes. AFHRL-TR-75-44(II), AD-A022 206. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 1137, Contract F41609-71-C-0033, System Development Corporation. NTIS.** If aptitude level for entry to an occupational specialty is set at higher or lower than optimal, there can be negative impacts on certain elements of this personnel system. This report considers personnel system actions that might offset these negative effects. Some relationships between system actions and Air Force needs are presented first. Then personnel system actions with

potential value are identified and judged for their impact on system elements. Finally, the actions so identified are evaluated for potential effectiveness in offsetting negative impacts under conditions of lower, and then higher, aptitude than the optimal. Some relative estimates of cost of system actions are given as examples of an approach to selecting actions for implementation. Of the five alternative actions evaluated, the most preferred was one that provides the greatest opportunity for exposure to a maximum of jobs within a specialty. (26 pp.)

495 **Maginnis, E.B., Uchima, A., & Smith, C.E. Establishing aptitude requirements for Air Force jobs: methodological approaches. AFHRL-TR-75-44(III), AD-A022 250. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 1137, Contract F41609-71-C-0033, System Development Corporation. NTIS.** This report presents, using a systems-oriented approach, alternative methodologies that could be used to establish aptitude requirements for Air Force occupations. It covers a description of the aptitude requirements system, a review of the interaction of aptitude requirements and personnel system actions, and a functional flow for the requirements system. A flow for the developmental activities necessary to design and implement the system is also given, followed by recommendations for development of a methodology for determining aptitude requirements for effective job performance, with separate consideration for optimal aptitude types and levels with respect to career development, assignment flexibility, and job satisfaction. (26 pp.)

496 **Mullins, C.J., Williams, J.D., Vitola, B.M., & Michelson, A.E. Effectiveness evaluation of Air Force advertising. AFHRL-TR-75-45, AD-A018 610. Lackland AFB, TX: Personnel Research Division, September 1975. Project 7719. NTIS.** The Airman Enlistment Questionnaire-R was administered to a sample of non-prior-service enlistees, 10,666 males and 1,806 females. Analysis of the responses indicates that: (1) enlistees are growing more aware of Air Force advertising, (2) females appear to be more alert to media programs than they used to be, (3) females are more interested in all kinds of Air Force jobs than they were, and (4) there are enough differences across geographic areas to justify close study of the possibility of differential advertising by geographic area. (74 pp.)

497 **Dansereau, D.F., Long, G.L., McDonald, B.A., Actkinson, T.R., Collins, K.W., Evans, S.H., Ellis, A.M., & Williams, S. Learning strategy training program: paraphrasing strategy for effective learning. AFHRL-TR-75-46, AD-A014 723. Lowry AFB, CO: Technical Training Division, June 1975. Project 1121, Contract F41609-74-C-0013, Texas Christian University. NTIS.** This report presents an effective integrated learning strategy program emphasizing a connection technique using paraphrasing. The components were derived from a review of the educational and psychological literature and from an analysis of the response to the learning strategy inventory, which were conducted during this same research effort. Also, two other training packages (visual imagery and question-answer connection) were evaluated along with this package in a controlled experiment. The results of this experiment showed improved long term retention, when using paraphrasing for the trained group, of 55% over an untrained control group. With appropriate insertion of blank pages this report can be used to provide learning strategy training. (204 pp.)

498 **Dansereau, D.F., Long, G.L., McDonald, B.A., Actkinson, T.R., Collins, K.W., Evans, S.H., Ellis, A.M., & Williams, S. Learning strategy training program: visual imagery for effective learning. AFHRL-TR-75-47, AD-A014 724. Lowry AFB, CO: Technical Training Division, June 1975. Project 1121, Contract F41609-74-C-0013, Texas Christian University. NTIS.** This report presents an effective integrated learning strategy program emphasizing a connection technique using visual imagery. The components were derived from a review of the educational and psychological literature and from an analysis of the responses to the learning strategy inventory, which were conducted during this same research effort. Also, two other training packages (paraphrasing and question-answer

connection) were evaluated along with this package in a controlled experiment. This program improved long term retention of factual material and appeared to help lower reading ability students more than higher ability students. With appropriate insertions of blank pages this report can be used to provide learning strategy training. (202 pp.)

499 **Dansereau, D.F., Long, G.L., McDonald, B., Actkinson, T.R., Collins, K.W., Evans, S.H., Ellis, A.M., & Williams, S. Learning strategy training program: questions and answers for effective learning. AFHRL-TR-75-48, AD-A014 725. Lowry AFB, CO: Technical Training Division, June 1975. Project 1121, Contract F41609-74-C-0013, Texas Christian University. NTIS.** This report presents an effective integrated learning strategy program emphasizing a connection technique employing questions and answers. The components were derived from a review of the educational and psychological literature and from an analysis of the responses to the learning strategy inventory, which were conducted during this same research efffort. Also, two other training packages (visual imagery and paraphrasing connection) were evaluated along with this package in a controlled experiment. This program improved long term retention of factual material. With appropriate insertions of blank pages this report can be used to provide learning strategy training. (206 pp.)

500 **Eddowes, E.E., McRee, P.L., Matheny, W.G., & Crowder, N.A. Preliminary operational evaluation of an audiovisual instrument trainer. AFHRL-TR-75-49, AD-A016 487. Williams AFB, AZ: Flying Training Division, July 1975. Project 1123, Contract F41609-73-C-0039, Life Sciences, Inc. NTIS.** The audiovisual instrument trainer (AVIT) presents multi-media instruction in aircraft instrument scanning interpretation, and flight path error correction procedures. This report describes a preliminary operational evaluation of the capability of AVIT to improve a student pilot's later instrument flying performance as measured in a T-4 simulator.

An operational evaluation of AVIT was conducted by the 64th Flying Training Wing at Reese AFB, Texas. The results of the evaluation test indicated that the AVIT-trained students made significantly more correct responses than student pilots not trained on AVIT. It was concluded that AVIT pretraining was effective as measured in this study. Consequently, it was recommended that further evaluation be accomplished to more adequately define the potential contribution of AVIT to UPT instrument training. (24 pp.)

501 **Hazel, J.T., Stacy, W.J., & Burtch, L.D. Assignment location preferences of airmen. AFHRL-TR-75-50, AD-A017 167. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 7734. NTIS.** To investigate assignment location preferences, a survey was administered to 4,670 airmen. Two preference ratings on an 18-point scale (−9 to +9) were obtained for each of 150 CONUS locations. One rating was obtained using base or station names. The other rating was based on an unnamed profile consisting of a 22 geographical-environmental variable description of each location. Findings were as follows: (a) Most preferred locations tended to be concentrated in Florida, California, and Colorado and least preferred locations in "northern tier" states. (b) Variability in base preference ratings increased with an increase in level of desirability. (c) The relative order of preferences for 150 locations differed for various subgroups of airmen. (d) Base name and location description rating differences suggested airmen may have a low level of awareness of certain geographical-environmental characteristics for CONUS locations. (e) Geographical-environmental variable differences were found between the 30 most and least preferred locations for 14 of 22 variables (e.g., snowfall, temperature). (52 pp.)

502 **Hughes, J.W. Career area rotation model: supplemental user's manual. AFHRL-TR-75-51, AD-A018 150. Lackland AFB, TX: Occupational and Manpower Research Division, September 1975. Project 2077. NTIS.** This report provides the user of the Career Area Rotation Model with specific instructions on the preparation of the input parameter cards necessary to initiate a program run. It also simplifies user interface with model by specifying the control card format and providing an accurate description of each card type. (32 pp.)

503 **Guinn, N. Identification of service irritants: Australia, Canada, United Kingdom and United States. AFHRL-TR-75-52, AD-A014 789. Lackland AFB, TX: Personnel Research Division, July 1975. Project DADD. NTIS.** A review of research on service irritants cited by military servicemen in Australia, Canada, United Kingdom, and United States revealed an outstanding degree of similarity in responses. Certain factors such as inadequate pay, domestic problems associated with military life, change of station, and military rules and regulations were universally mentioned as negative aspects of a military career. The effect of these irritants on enlistment motivation, job satisfaction, and retention was discussed. (24 pp.)

504 **Wiley, L.N. Potential uses of the functional account code in describing job requirements. AFHRL-TR-75-53, AD-A018 609. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 7734. NTIS.** A major problem in the utilization of personnel appears when one attempts to identify skills and knowledges acquired in job assignments held in the past. Lack of regular job inventorying of Air Force personnel by individuals rather than samples makes it infeasible to use job inventories to recapture a given airman's record. Present plans to broaden the use of identifiers of special skills may correct this deficiency for future airmen, but they fail to do so for the bulk of current personnel. A possibility of using the Functional Account Code (FAC), assigned by the management engineering team (MET), was perceived, and a pilot study performed to verify the potential. This was possible because a file of records on all studies clustering job inventories from 1965–1971 had just been readied, with the FAC for each airman included. It was first shown that when individuals are sequenced by FAC, the job clustering corresponds well with the Functional Account Code. Seventy-five AFSCs are shown in graphic form. A more intensive analysis was then made of the Administration Specialist ladder, which contains the largest number of FACs of any specialty, in which it was found that FAC titles agreed well with the titles assigned to job clusters by the analyst who interpreted the homogeneous grouping of the job inventories. Longitudinal analyses are planned as a follow-on. (16 pp.)

505 **Alley, W.E., & Gould, R.B. Feasibility of estimating personnel turnover from survey data—a longitudinal study. AFHRL-TR-75-54, AD-A018 777. Lackland AFB, TX: Personnel Research Division, October 1975. Project 7719. NTIS.** This report investigates the validity of career intent and job attitude statements for predicting reenlistments among 54,803 airmen in 101 enlisted specialties. Statements were made while completing Air Force occupational surveys during the period 1966 to 1971. Frequency and percentage distributions characterizing item responses and career decisions of the sample are given. Relationships between career intent/job attitude responses and actual reenlistment decisions were studied using multiple linear regression techniques. Job attitudes were found to be substantially related to career decisions but did not provide unique contributions to predictions of career decisions when used in conjunction with career intent statements. A model-seeking exercise identified a second-degree polynomial model with career intent and time-in-service interaction vectors as the most appropriate prediction model. Separate prediction equations were obtained for a number of selected subsamples representing two, three, and five-digit Air Force specialty code and aptitude requirement groupings. Homogeneous grouping exercises were performed to illustrate a procedure for reducing the number of subsample prediction equations to a minimum subset.

Practical examples of forecasting reenlistment rates are illustrated. The regression model selected for the demonstration used weights derived from the total sample to predict the percentage of actual reenlistments for thirty specialties. Overall, approximately 17 percent of the sample remained in service. The average difference between actual vs predicted reenlistment rates across specialties ranged from 9 percent for airmen surveyed in their first year to 8 percent, 6 percent and 2 percent for airmen in their second through fourth year of service, respectively. (30 pp.)

506 **Brown, J.E., Waag, W.L., & Eddowes, E.E. USAF evaluation of an automated adaptive flight training system. AFHRL-TR-75-55, AD-A018 612. Williams AFB, AZ: Flying Training Division, October 1975. Project 1123. NTIS.** The objectives of the study were: (1) to evaluate the training effectiveness of the Automated Flight Training System (AFTS) in the F-4 training program; (2) to identify desired hardware and software modifications for operational AFTS devices; and (3) to identify effective methods of operational training use. The study was performed at Luke AFB, Arizona, at the request of the Tactical Air Command (TAC). A class of 24 students assigned to F-4 combat crew training was randomly divided in two equal sized groups. One group received GCA training using the AFTS. The other group received normal GCA training from F-4 instructors. Performance data, questionnaire data, and maintenance data were collected and analyzed. Implications of the data for future use and procurement of additional systems are discussed. (62 pp.)

507 **Wiley, L.N. Ratings of first-term airmen on supervisory potential and technical competence in AFSCs 462X0 and 812X0. AFHRL-TR-75-56, AD-A019 560. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 7734. NTIS.** A study was undertaken to determine if supervisors can rate the potential of first-term airmen to become supervisors. Ratees were 313 Weapons Mechanics, AFSCs 462X0 and 461X0, and 421 Law Enforcement Specialists, AFSCs 812X0 and 811X0, who were rated on 3 criteria and 30 job behavioral traits by their supervisors in CONUS. The criteria of (1) supervisory potential, (2) technical competence, and (3) desirability as a reenlistee were predicted from their correlation with the 30 trait ratings by linear regression techniques. The aim was to see if the Weapons Mechanic and Law Enforcement specialties differed in their supervisory trait requirements, and if supervisor potential is distinguishable from technical competence. The first two criteria correlated .89 with each other, while the criterion of desirability as a reenlistee had to be discarded because it was not uniformly interpreted by the raters. Both technical competence and supervisory potential were highly predictable from trait ratings, 86 and 84 percent, respectively. However, through direct examination of the data and the supervisors' comments, it was concluded that the supervisory requirements of the two specialties actually differ, and that technical competence is an element of supervisory potential, a necessary but not sufficient attribute of a future supervisor. (22 pp.)

508 **Hickerson, K.A., Hazel, J.T., & Ward, J.H., Jr. A causal analysis of relationships between performance and satisfaction in eight airman specialties. AFHRL-TR-75-57, AD-A020 542. Lackland AFB, TX: Occupational and Manpower Research Division, October 1975. Project 7734. NTIS.** Longitudinal relationships, between two measures of both job performance and job satisfaction over a three-year period, were investigated for 1,352 airmen in eight enlisted Air Force occupational specialties. Cross-lagged panel correlation analyses were compared to conclusions based upon an extended multiple linear regression analysis technique. Data are presented which suggest causal influence between performance and satisfaction in two of the eight specialties. Other results indicated that the performance-satisfaction relationship is a complex one dependent upon the models used for investigation, the satisfaction, performance, and moderating variables selected, and the particular job specialty under consideration. The report includes a presentation of the linear regression models employed in the analysis, and a bibliography of performance-satisfaction research. (44 pp.)

509 **Long, G.E., & Varney, N.C. Automated pilot aptitude measurement system. AFHRL-TR-75-58, AD-A018 151. Lackland AFB, TX: Personnel Research Division, September 1975. Project 1137, Contract F41609-73-C-0037, McDonnell Douglas Astronautics Co. – East. NTIS.** This study addresses the problem of predicting success in undergraduate pilot training (UPT) through the measurement of performance on a learning sample of flight tasks administered prior to the initiation of training. The learning sample which would be used to augment existing pilot selection procedures was proposed as a means of reducing attrition during UPT.

Performance measures on a five hour learning sample of flight tasks, administered with an Automated Pilot Aptitude Measurement System (APAMS) were collected from 178 candidates for UPT selected for training with current procedures. These performance measures were then compared with performance during T-41 and T-37 phases of UPT.

The results indicated that performance in both phases of training could be predicted from performance on the learning sample. Grades given by instructors in T-41 training were highly correlated with performance measures on the learning sample. Also, candidates who were eliminated from both phases of training, including those eliminated for Manifestation of Apprehension (MOA), Self Initiated Elimination (SIE), as well as eliminees for Flying Training Deficiency (FTD) could be discriminated by their performance on the learning sample.

The results indicated that the learning sample approach could contribute substantially to existing pilot selection procedures in reducing current attrition rates in UPT. (134 pp.)

510 **Gum, D.R., Albery, W.B., & Basinger, J.D. Advanced simulation in undergraduate pilot training: an overview. AFHRL-TR-75-59(I), AD-A030 224 Wright-Patterson AFB, OH: Advanced Systems Division, December 1975. Project 1192. NTIS.** An overview of the entire Advanced Simulation in Undergraduate Pilot Training (ASUPT) program is presented to provide the reader with a general introduction to the research system. The three major components of the ASUPT are summarized, including the basic simulators, visual displays, and computer image generation (CIG) system, and interested readers are referenced to the six other volumes of this technical report for more specific and detailed information. This volume touches upon the highlights of the ASUPT design, development, and testing and includes the general progress of the program from its genesis in 1967 to the final acceptance of the simulator in January 1975. (28 pp.)

511 **Kron, G.J. Advanced simulation in undergraduate pilot training: motion system development. AFHRL-TR-75-59(II), AD-A017 467. Wright-Patterson AFB, OH: Advanced Systems Division, October 1975. Project 1192, Contract F33615-71-C-1255, Singer-Simulation Products Division (SPD). NTIS.** The production of kinesthetic information pertinent to the aircraft piloting task by use of motion base devices relies on mathematical models which are developed in a largely empirical manner and evaluated in a subjective manner. The ASUPT simulator contains a motion math model which is developed in analytical fashion and permits broad latitude for experimenter input to alter or degrade the resultant motion information. This permits research that is useful in establishing a relationship between the amount and scope of motion information and training value. The motion system employed is a 60-inch six-degree-of-freedom synergistic system. It is driven in translation by a model which permits passage of acceleration onset information followed by controlled velocity and position washout. Rotational information is controlled by digitally implemented cue shapers, and sustained translation acceleration simulation is made available by subliminally tilting the motion system platform to cause a projection of the gravity vector to be aligned with the sustained force. This report discusses the implementation of these concepts, and forms a foundation for understanding the ASUPT motion system computer programs. (78 pp.)

512 **Kron, G.J. Advanced simulation in undergraduate pilot training: G-seat development. AFHRL-TR-75-59(III), AD-A017 468. Wright-Patterson AFB, OH: Advanced Systems Division, October 1975. Project 1192, Contract F33615-71-C-1255, Singer-Simulation Products Division (SPD). NTIS.** Kinesthetic (sensation of motion) cues in aircraft pilot training simulators are generated by motion base systems that stimulate the vestibular and somatic, or "body feel," sensory systems. The nature of the somatic system suggests that it may also be possible to stimulate this system directly by employing a seat whose shape varies as a function of computed aircraft accelerations. A research facility G-seat has been developed to investigate this method of stimulation using a simulated T-37B aircraft cockpit. The experimental seat contains mosaics of sixteen air cells forming the seat

cushion and nine air cells forming the backrest cushion. Three air cells on either side of the seat apply thigh pressure and the lap belt is driven to provide ventral area pressure variation. Somatic system stimuli are provided by causing the surface positions of these cells to be varied independently under computer control. A general-purpose research-oriented drive model incorporating six basic drive concepts and easily accessed control parameters permitting concept blending has been developed for cell excursion control. Development phase findings germane to the problem of developing a system suitable for somatic system stimulus production as well as preliminary observations concerning the ability of this system to induce kinesthetic sensation are presented.

The word somatic refers to the body walls or framework of the body. Somatic receptors respond to mechanical stimulation of the skin and underlying tissues, rotation or bending of joints, temperature changes, and possibly some chemical changes. The somatic system is referenced in this report as the haptic system, or the tactile (touch) sense.

However, in the general sense, it is the somatic system which is being stimulated by the G-seat, as somatic receptors respond to sensations of not only touch, but also pressure and the awareness of the position and movements of the parts of the body (proprioception). (60 pp.)

513 **Faconti, V., & Epps, R. Advanced simulation in undergraduate pilot training: automatic instructional system. AFHRL-TR-75-59(IV), AD-A017 165. Wright-Patterson AFB, OH: Advanced Systems Division, October 1975. Project 1192, Contract F33615-71-C-1255, Singer-Simulation Products Division (SPD). NTIS.** This report describes the automated instructional system designed for the ASUPT simulator. Each hardware and software element is described with emphasis given in areas which presented significant design problems such as manual page preparation, data recording, preprogramming, etc. The system is the implementation of concepts investigated in the report, *Automated Instruction and Performance Monitoring In Flight Simulation* (AFHRL-TR-69-29).

The ASUPT system included requirements for capabilities related to performing research in training technology. In order to accomplish this, AFHRL established the need for the most sophisticated repertoire of instructional features ever included in a flight training system. The features covered in this category are designed to enhance the training effectiveness of the device, or more precisely, provide research capability in this area. The systems are designed to implement the concepts of learning theory. These include such concepts as performance feedback, knowledge of results, positive reinforcement, etc. This report describes the resulting system in an overall manner and discusses certain areas in more detail due to the unique design problem presented. (68 pp.)

514 **Beardsley, H., Bunker, W., Eibeck, A., Juhlin, J., Kelly, W., Page, J., & Shaffer, L. Advanced simulation in undergraduate pilot training: computer image generation. AFHRL-TR-75-59(V), AD-A022 251. Wright-Patterson AFB, OH: Advanced Systems Division, November 1975. Project 1192, Contract F33615-72-C-1717, General Electric Company. NTIS.** This report describes the Computer Image Generation System developed for the Advanced System for Undergraduate Pilot Training Program. The system has been installed and will be operated at Williams AFB, Arizona.

The Advanced Simulation for Undergraduate Pilot Training (ASUPT) system is an advanced simulation system that will be used in a research program by the Air Force Human Resources Laboratory (AFHRL) to investigate the simulator role in future Undergraduate Pilot Training programs. The ASUPT simulates the Air Force's primary jet trainer, the Cessna T-37B aircraft. A Computer Image Generator (CIG) system has been developed under AFHRL contract F33615-72-C-1717 to the General Electric Company to provide for a visual simulation of the terrain and other aircraft for research operations in the T-37B aircraft simulator. This CIG development represents an advancement in image generation technology for visual simulation.

The purpose of this report is to document the technical development and capabilities of this ASUPT visual simulation system (and thereby, its related technology area) for dissemination to interested and concerned Air Force and Department of Defense personnel and the scientific

community. This report progressively discusses the origin of the ASUPT program and its CIG visual system requirement, the requirements placed upon the system, a physical and functional operation description of the system, noteworthy special sytem features, and system acceptance results. (274 pp.)

515 **Nass, L., Seats, P., & Albery, W.B. Advanced simulation in undergraduate pilot training: visual display development. AFHRL-TR-75-59(VI), AD-A022 962. Wright-Patterson AFB, OH: Advanced Systems Division, December 1975. Project 1192, Contract F33615-71-C-1255, Singer-Simulation Products Division (SPD). NTIS.** Visual simulation and its application to flying training is in its infancy. The development of the two visual display systems including the infinity optics, support structures, and 36-inch diameter (the world's largest) cathode ray tubes described in this report has already produced a worthwhile legacy to the state of the art of visual simulation.

The development of the visual display systems for the advanced simulator for undergraduate pilot training (ASUPT) is generally described as three separate efforts: (a) in-line infinity optics, or pancake window development, (b) dodecahedron structure development, and (c) cathode ray tube (CRT) development.

The genesis of all three of these efforts represents individual contributions to the state of the art. The pancake windows are the largest of their kind ever developed. The simulator for air-to-air combat employs similar windows, structures, and CRTs but the windows and CRTs are scaled-down versions of the ASUPT designs. The ASUPT visual display structures were tested under dynamic conditions on a motion platform in early 1972; the structural integrity of the dodecahedron design was verified. The CRTs represent, perhaps, the most important element of the ASUPT. For it is the remarkable development of these, the world's largest, hand-crafted TV tubes that not only paced the entire progress of the program, but also provided the ASUPT with its "eyes" and made it the valuable asset that it is today. (122 pp.)

516 **Larson, D.F., & Terry, C. Advanced simulation in undergraduate pilot training: systems integration. AFHRL-TR-75-59(VII), AD-A017 210. Wright-Patterson AFB, OH: Advanced Systems Division, October 1975. Project 1192, Contract F33615-72-C-1557, Singer-Simulation Products Division (SPD). NTIS.** Problems and solutions during integration of the ASUPT basic simulator with the computer image generation (CIG) visual system are described. Problems such as spin, stall, attitude control, and timing synchronization are addressed along with the methods and techniques employed to upgrade the basic simulator dynamics to meet the resolution and response fidelity required for smooth, responsive visual imagery. (66 pp.)

517 **Hunter, D.R. Development of an enlisted psychomotor/perceptual test battery. AFHRL-TR-75-60, AD-A020 544. Lackland AFB, TX: Personnel Research Division, November 1975. Project 7719. NTIS.** A battery of seven psychomotor/perceptual tests, developed by Biotechnology, Incorporated, of Falls Church, Virginia, was administered to 380 airmen assigned to the 3701 Personnel Processing Squadron at Lackland Air Force Base, Texas. A paper-and-pencil battery of 21 tests was also administered to the airmen.

The objectives of the project were to determine the psychometric characteristics of the psychomotor/perceptual battery and to compare the performance of "high" and "low" ability airmen (as determined by Armed Forces Qualification Test scores).

Analysis of the data indicated that the measures obtained from the psychomotor/perceptual battery were generally highly reliable. Factor analyses resulted in the identification of six factors that were specific to the psychomotor/perceptual battery, four factors that were specific to the paper-and-pencil measures, and one factor that was common to both batteries.

The sample of subjects was divided into upper and lower groups based upon AFQT scores. The performance of the upper and lower groups on the paper-and-pencil and psychomotor/perceptual

batteries was compared and differences evaluated for statistical significance. It was found that the differences between the upper and lower groups were generally much smaller on the psychomotor/perceptual tests than on the paper-and-pencil measures.

Recommendations for subsequent research and development are given. (46 pp.)

518 **Foley, J.P., Jr. Criterion referenced measures of technical proficiency in maintenance activities. AFHRL-TR-75-61, AD-A016 420. Wright-Patterson AFB, OH: Advanced Systems Division, October 1975. Project 1710. NTIS.** This paper concerns instruments used in the determination of how efficiently maintenance men perform the various tasks of their jobs. Currently, a great deal of reliance is placed on unvalidated knowledge tests, theory tests, school marks, and supervisor's ratings for such determination. This paper presents a composite of the results of such instruments. These results indicate that these measurement instruments have low empirical validity. The limitations of traditional systems effectiveness measures are also discussed. The limitations of all these measurement procedures are not widely known by maintenance supervisors, training managers and maintenance instructors. Although job task performance tests (JTPT) have higher empirical validity, such tests have had very limited use because of their relatively high cost in time, personnel and equipment. As a result of the foregoing findings, the Air Force Human Resources Laboratory (AFHRL) supported a series of efforts to develop better criterion referenced JTPT, and to attempt the development of paper and pencil symbolic substitute tests of high empirical validity.

The paper describes the model battery of 48 criterion referenced JTPT, which has been developed to cover all key maintenance activities such as checkout, align/adjust, remove/replace, troubleshooting, test equipment and soldering. During this development many factors were considered including the identification and classification of tasks to be measured, the hierarchal relationship of maintenance tasks, the most effective order of their measurement and the ease of test administration. This battery was developed as a model of JTPT to be used on the job and in training.

It was also intended as a battery of criterion tests for the validation of paper and pencil symbolic substitute tests. Batteries of graphic and video symbolic substitute tests were developed and given limited validations. The validation of graphic symbolic substitute tests indicated that the symbolics for all activities with the exception of soldering, have promise. The paper discusses the requirements for additional refinement and validation for the various graphic tests. An unsuccessful effort to develop video symbolic tests is also mentioned. Suggestions are made for the application of criterion referenced JTPT for the improvement of maintenance efficiency. (10 pp.)

519 **De Vries, P.B., Jr., Yakimo, R., Curtin, J.G., & McKenzie, J.F., Jr. Undergraduate navigator training attrition study. AFHRL-TR-75-62, AD-A020 115. Williams AFB, AZ: Flying Training Division, November 1975. Project 1123, Contract F41609-73-C-0036, McDonnell Douglas Astronautics Co – East. NTIS.** This study was designed to identify and define the factors which contribute to undergraduate navigator training (UNT) attrition and to present recommendations to reduce the effects of those factors. Longitudinal data were collected from six UNT classes and augmented with cross-sectional data from a sample of 15 UNT classes. The student data are composed of the results of interviews, a test battery and record information. In addition, a sample of instructors was interviewed and tested. Data analysis provided evidence to support recommendations in the areas of selection, course modification and Air Force policy. (164 pp.)

520 **Carpenter, J.B., Giorgia, M.J., & McFarland, B.P. Comparative analysis of the relative validity for subjective time rating scales. AFHRL-TR-75-63, AD-A017 842. Lackland AFB, TX: Occupational and Manpower Research Division, December 1975. Project 7734. NTIS.** This report summarizes the results of two separate investigations aimed at determining the inherent accuracy of derived job descriptions. Since the accuracy and validity of occupational data may be differentially affected by the rating scale format employed in gathering the data, the first phase of the research reported incorporates hypothetical job descriptions from which accurate criterion data could be generated.

The second phase of the research necessitated the development of an occupational survey instrument specifically designed for Air Force basic trainees. Actual time spent measures supplied by supervisors were found to have sufficient reliability for use as a criterion in this phase of the investigation. Criterion comparison (CRICOM) or error values were used with an analysis of variance design to determine the relative validities for subjective time rating scales. In general, five-point relative scales were found to be inferior to the other scales used in this study. It was further established that job incumbents can use scales of greater complexity (e.g., a wider range of response options) than had previously been indicated in the literature. The discrepancies in estimates of absolute time or percentage values previously reported were confirmed, but the inaccuracies within this approach were found to relate only to the absolute raw values. When these absolute values were treated as relative indices, no significant differences in the validity of the derived job descriptions were universally obtained. Results of this investigation were interpreted to indicate that a 9-point relative time spent scale represents an optimal solution to the interactive problems of complexity and efficiency with regards to obtaining viable job description data from job incumbents using the Air Force developed occupational analysis methodology. (52 pp.)

521 **Reed, L.E., Snyder, M.T., Baran, H.A., Loy, S.L., & Curtin, J.G. Development of a prototype human resources data handbook for systems engineering: an application to fire control systems. AFHRL-TR-75-64, AD-A019 553. Wright-Patterson AFB, OH: Advanced Systems Division, December 1975. Project 1124. NTIS.** The methods and problems encountered in the development of a prototype human resources data handbook are discussed. The goal of the research was to determine whether it was feasible to consolidate, in a single comprehensive handbook, human resources data applicable to system design and development. Selected for this purpose were data on the functions performed by the 32XXX avionics career field on the fire control system of nine Air Force fighter systems. This report discusses the methods used and the problems encountered during the development of the prototype handbook. This prototype handbook, presented in Appendix A, was designed for ease of use and was organized into three major data sections. Section I was reserved for data comparisons on system design, training, manpower, occupational tasks, maintenance procedures, etc. Included in Section II were data on past, current, and projected numbers of personnel, various skill levels, etc. Section III was reserved for technical information that could be generalized to a wide variety of problems. Included in this last section were data on the effects of task difficulty, error rates in performing maintenance activities, etc. (226 pp.)

522 **Bergmann, J.A., & Smith, M.C. Occupational analysis of Air Force Reserve and Air National Guard nurses. AFHRL-TR-75-65, AD-A020 116. Lackland AFB, TX: Occupational and Manpower Research Division, November 1975. Project 7734. NTIS.** The purpose of this study was to complete an occupational analysis comparing active duty and Reserve Forces nurses to provide insight into future nurse requirements. This is one of a series of reports concerning the Air Force's health care delivery system and marked the initial application of job inventory methodology to non-active duty forces. A sample of 452 Air Force Reserve nurses, 160 Air National Guard nurses, and 1,332 randomly selected active duty nurses was used for the analysis. The data were analyzed by use of the Comprehensive Occupational Data Analysis Program (CODAP). Comparative evaluations of job content for the three nursing groups were performed, and job types identified based on the occupational analysis. This data should assist in identifying work areas in which these forces can be optimally utilized without additional training, and areas requiring remedial training if called to active duty. (60 pp.)

523 **Burtch, L.D., & Hazel, J.T. Relation of airmen job attitudes to participation in sports and leisure activities. AFHRL-TR-75-66, AD-A020 091. Lackland AFB, TX: Occupational and Manpower Research Division, November 1975. Project 7734. NTIS.** Participation in several sports and leisure

activities was examined to determine the relationship of such variables with job attitudes (i.e., reenlistment intent and job satisfaction). Tennis, fishing, hard rock music, and country/western music were among those predictors that significantly correlated with job attitudes. Swimming, fishing and camping were also found to be the most popular sports whereas golf and tennis were the least popular. Some variation in the order of popularity was noted between first-term and career airmen. However, the activity predictors only slightly contributed to the prediction of job attitudes when a measure of job tenure (i.e., time in service) was held constant. (18 pp.)

524 **Koym, K.G. Development of physical demand profiles for four airman career ladders. AFHRL-TR-75-67, AD-A020 118. Lackland AFB, TX: Occupational and Manpower Research Division, November 1975. Project 7734. NTIS.** The purpose of this study was to examine the feasibility of estimating physical demands in jobs using incumbent ratings, and to compare physical demand profiles for four career ladders. Job incumbents were asked to rate 10 physical characteristics and 5 lifting requirements on the amount of physical demand present in their jobs. High interrater reliability estimates were obtained in each ladder relative to the physical demand ratings. Mean physical demand ratings were plotted (i.e., profiled) and compared. Analyses of variance reflected significant mean differences among the career ladders for 14 of the physical demands investigated. Profiles for first-term and careerist airmen were compared using within and across career ladder correlational analyses. The within ladder groupings of first-term and careerist airmen produced substantially higher correlations than profiles for across ladder groupings of first-term and careerist airmen. It appears feasible to obtain physical demand data from job incumbents. (20 pp.)

525 **Smith, E.A., Hall, P.W., & Manson, J.B. Techniques for generating instructional slides. AFHRL-TR-75-68, AD-A020 543. Lowry AFB, CO: Technical Training Division, November 1975. Project 1121. NTIS.** The visuals used in carrels in learning centers are normally produced in one of three ways. They may be photographs of objects or procedures. They may be drawings rendered by a graphics specialist. The third type, and the one of particular relevance in this report, are the images that can be prepared on a typewriter. These would be questions, verbal instructions, outlines, key points, or any other content that can be prepared by typing. While this type of slide is common in briefings, the large volume of them required in individualized instruction warrants spending considerable time and effort in developing an efficient and effective method of producing them rapidly yet with acceptable quality.

Within this context, this report describes some techniques that might facilitate the production of instructional slides for use in training programs. The information is organized into initial sections describing formatting and the preparation of copy for slides followed by sections describing how this copy is used in the preparation of slides utilizing (a) ortho or high contrast film, (b) diazo type materials, (c) double exposures, and (d) positive slides. The final chapter describes the captioning of photos as a technqiue for producing instructional sequences. (28 pp.)

526 **Spangenberg, R.W., & Smith, E.A. Handbook for the design and implementation of Air Force learning center programs. AFHRL-TR-75-69, AD-A028 623. Lowry AFB, CO: Technical Training Division, December 1975. Project 1121. NTIS.** This report provides guidance in designing and implementing a performance oriented learning center program for Air Force training. Sections are entitled Orientation, Establishing a Learning Center, Courseware Preparation, Media Courseware Production, Hardware, Learning Environment and Carrel Design, Physical Plant, and Quality Assurance. Recommendations and working conclusions, based on the current state-of-the-art, are presented in a simple how-to-do-it manner. Many additional resources are cited for those who desire to explore various aspects of instructional technology, as applied to learning center programs. (110 pp.)

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527 **Miller, G.G., & Gardner, E.M. Advanced simulator performance specification for an F-111 test station. AFHRL-TR-75-70, AD-A025 853. Lowry AFB, CO: Technical Training Division, November 1975. Project 1121. NTIS.** This report contains performance specifications for a maintenance simulator to be used to train operation and maintenance of the 6883 Converter/Flight Controls Test Station for the F-111 aircraft. The maintenance simulator will be used in Air Force resident training to train technicians to perform intermediate level (I-level) maintenance tasks. The performance specification is the first phase of an effort to develop a prototype simulator. An improved technique for gathering task analytic data for making functional fidelity decisions is discussed. The basic design approach reported herein centers around a simulator that will look like the real equipment and exhibit psychologically similar outputs, but will not require the complex internal circuitry. (82 pp.)

528 **Ward, J.H., Jr., & Haltman, H.P. Computer-based enlistment quota reservation system using the general data management system 2000: programming and implementation details. AFHRL-TR-75-71, AD-A021 340. Lackland AFB, TX: Occupational and Manpower Research Division, December 1975. Project 2077. NTIS.** This report describes the capabilities and gives a step-by-step guide to the implementation of a computer-based quota reservation system using the general data management System 2000. The system was designed as a feasibility demonstration for the Air Force Recruiting Service staff. Operational commands are described which allow a user to search the data base to locate enlistment openings. The user can also reserve an enlistment opening when the applicant is ready to accept a position. Management summary commands are available that summarize openings and enlistments by Air Force specialty code, aptitude area and other categories.

The implementation steps involve defining the data base, loading the enlistment-type information, attaching the previously reserved applicants, and defining the special functions and comments.

Of particular interest is the technique for easily developing and modifying comments to be used for sending messages from the computer to the user using only System 2000 language.

A general data management system such as System 2000 can be a useful tool for rapid incremental development of a wide variety of management information systems. (62 pp.)

529 **Smith, B.A., Waters, B.K., & Edwards, B.J. Cognitive pretraining of the T-37 overhead traffic pattern. AFHRL-TR-75-72, AD-A026 118. Williams AFB, AZ: Flying Training Division, December 1975. Project 1123. NTIS.** This study investigated the utility of a cognitive pretraining instructional package to the training of the T-37 overhead traffic pattern used in Air Force undergraduate pilot training (UPT). A multi-media package was prepared following instructional systems development (ISD) procedures. The package included a programmed text, sound/slide briefing, 8mm motion picture sequence and a 49 item multiple-choice criterion measure. Instructional material was validated using three UPT classes at Williams AFB, Arizona.

An evaluation of the effectiveness of the instructional package was performed using two student sections from class 76-05 (n = 15 each) as experimental (E) and control (C) groups. Criterion test scores and inflight T-37 instructor pilot rated performance were used as dependent variables. Results showed consistent, significantly better student performance on all measures by E, particularly in early training. Overall, the instructional program significantly improved the student pilot's recognition of critical cues, increased student knowledge, confidence, and coordination as rated by the instructor pilots, and resulted in an average of two less flights per subject to attain criterion performance on the task.

The authors recommend implementation of the cognitive pretraining package into the UPT curriculum throughout Air Training Command (ATC) and that ATC apply the concept of cognitive pretraining in the development of curriculum to train other complex psychomotor tasks. The technique appears to be both efficient and cost-effective. (58 pp.)

530 **Kantor, J.E., & Guinn, N. Comparison of performance and career progression of high school graduates and non-graduates in the Air Force. AFHRL-TR-75-73, AD-A022 973. Lackland AFB, TX: Personnel Research Division, December 1975. Project 7719. NTIS.** The performance and career progression of a sample of 20,705 airmen were monitored throughout their initial tour of service. For comparative purposes, this sample was divided into high school graduate and non-graduate groups and further subdivided by Armed Forces Qualification Test (AFQT) mental categories. Points of comparison included: disposition from basic military and technical training, attainment of skill levels, number of disciplinary actions and unsuitability discharges, and reenlistment decision. On almost all measures, high school graduates constituted a significantly more successful military group than did the non-graduates, and among the non-graduates, in terms of mental category subgroups, there were almost no differences in performance. In addition, the effects of varying enlistment requirements on this sample are presented, and attention was directed toward determining which non-graduates might be better risks than others for military service. (20 pp.)

531 **Headquarters Air Force Human Resources Laboratory. Fiscal Year 1977–Air Force technical objective document. AFHRL-TR-75-74, AD-A018 750. Brooks AFB, TX: Headquarters Air Force Human Resources Laboratory, December 1975. (Covers all AFHRL projects). NTIS.** This document provides the academic and industrial R&D community with a summary of the technical area objectives of Air Force research in the field of human resources. The areas covered are: (a) Personnel Systems Technology and Utilization; (b) Education and Training Technology; (c) Performance Evaluation; and (d) Human Resources Data and Systems Design and Operation. (20 pp.)

532 **Filinger, R.H., & Hall, P.W. Investigation of electronic generation of visual images for Air Force technical training. AFHRL-TR-75-75, AD-A026 119. Lowry AFB, CO: Technical Training Division, December 1975. Project 1121. NTIS.** Conventional approaches to audiovisual software preparation are no longer sufficient to meet increased visual requirements created by implementation of large scale, individualized learning systems. The problem rests primarily with conventional methodologies; electronic image generation was investigated as a possible alternative. A prototype, experimental device, the Scanimate-500, designed and built by the Computer Image Corporation, Denver, Colorado, was investigated. The Scanimate utilizes photographic, television, and computer electronic technologies to produce 35mm slides as an end product. This report covers a 60-day evaluation of the prototype device in an operational setting after a year of research and development. Results indicate a developing technology with a methodology still largely undefined. Electronic image generation proved viable for certain slide categories – especially where repeated use of basic visual elements was necessary (progressive disclosure, nomenclature, etc.). It would not be unreasonable to estimate that as high as 15% of any total graphics requirement could be electronically processed efficiently and cost-effectively. Eight productions were accomplished during the 60-day period with varying degrees of success. A broader, continued research effort is in progress to perfect the technological approach. (14 pp.)

533 **Alley, W.E., & Berberich, G.L. A procedure for estimating enrollment and cost factors at potential AFROTC host-sites. AFHRL-TR-75-76, AD-A025 849. Lackland AFB, TX: Personnel Research Division, December 1975. Project 7719. NTIS.** This report is one of a series describing (a) the development of effectiveness criteria for AFROTC detachments, and (b) relationships between the criteria and various environmental and program characteristics. The objective of this report was to develop a method for estimating student enrollments and total operating costs at prospective host-site institutions by using institutional measures which were easily updated. Standard multiple regression techniques were used in the analysis. The predictors were chosen for their high validity and their easy access in an operational setting. Utilizing the equations and procedures set forth in the report, cost and enrollment figures can be derived for potential AFROTC host-sites. (14 pp.)

534 **Hendrix, W.H., & Ward, J.H., Jr. Preferred job assignment effect on job satisfaction. AFHRL-TR-75-77, AD-A021 341. Lackland AFB, TX: Occupational and Manpower Research Division, December 1975. Project 2077. NTIS.** The current post-enlistment assignment process used by the Air Force permits recruits to indicate three job preferences. This report focused on this process of indicating a preference, and attempted to answer the question of whether indicating an Air Force specialty (AFS) preference and subsequently being assigned to the job preference selected, effected job satisfaction. Subjects were first term airmen (females = 4,156, males = 15,000) who had completed, during their first tour of duty, a job inventory which contained three items related to job satisfaction. A series of analyses were performed in order to see if the preference selection process was related to the three measures of job satisfaction. Results indicated that the preference selection process was related ($p < .01$) to two of the job satisfaction scales. The question of practical significance was raised and recommendations offered. (16 pp.)

535 **Weeks, J.L., Mullins, C.J., & Vitola, B.M. Airman classification batteries from 1948 to 1975: a review and evaluation. AFHRL-TR-75-78, AD-A026 470. Lackland AFB, TX: Personnel Research Division, December 1975. Project 7719. NTIS.** From 1948 to 1975, the United States Air Force employed ten different multiple aptitude batteries for the purpose of either classifying or selecting and classifying nonprior service enlistees. Each of the different batteries is described and evaluated in terms of standardization, reliability, and validity. (56 pp.)

536 **Watson, W.J., & Goody, K. Matching job education requirements with candidates' educational attainments–a pilot methodological study. AFHRL-TR-75-79, AD-A025 214. Lackland AFB, TX: Occupational and Manpower Research Division, December 1975. Project 7734. NTIS.** The traditional methods for documenting educational achievements have limited application for prescribing desirable and mandatory educational prerequisites for service in the various officer utilization fields. There is no standard terminology or format for the various colleges throughout the United States of America, and so the college transcript is an ambiguous document. This report describes an education profile that was developed to display a candidate's educational achievements in a simple, standard, quantified format. It was found that the data in college transcripts could be condensed into these profiles with a high degree of reliability.

It was also demonstrated that a sample of "experts" could rate, with a high degree of interrater reliability, a collection of such profiles on educational suitability for service in the Administrative Officer Utilization Field (AFSC 70XX). Furthermore, regression analysis established that these ratings (or "educational suitability indexes") could be satisfactory duplicated by mathematical equations using a limited number of aspects of the education profiles as predictor variables.

This was a pilot methodological study. Hence, the sample of raters used was not random, and only one utilization field was studied. However, the results are sufficiently convincing to justify further research. The findings supported the feasibility of developing a series of mathematical equations for computing, from education profiles, educational suitability indexes for each of a variety of utilization fields. (18 pp.)

537 **Stacy, W.J., Matthews, G.N., & Hazel, J.T. Determination of officer grade requirements by management engineering teams. AFHRL-TR-75-80, AD-A025 309. Lackland AFB, TX: Occupational and Manpower Research Division, December 1975. Project 7734. NTIS.** Management engineering teams (MET) were used in the development and testing of a methodology for determining non-aircrew officer grade requirements. The methodology tested was an extension of the Officer Grade Requirements (OGR) procedure developed during the 1963–1966 time period. In the OGR project, a criterion board rated 3,575 officer jobs for grade, then a nine-variable multiple regression equation was developed which efficiently predicted the criterion ratings.

In the current application, the METs rated 485 officer jobs from the OGR job sample and 1,687 new jobs. For the 485 job sample, predicted composite scores were obtained from MET ratings

utilizing the nine-variable regression equation. These scores were correlated with the criterion board ratings on the same jobs, producing a validity coefficient of .90. An interrater reliability of .95 on the total 2,172 jobs was obtained for these raters. These results indicate that METs can reliably rate officer jobs for determination of grade and can accurately replicate the criterion board ratings.

Recommendations were made for operational implementation and for further research to provide a more stable grade conversion table and to determine the total distribution of non-aircrew officer grade requirements. (38 pp.)

538 **Gardner, E.M., & McKnight, L.R. Development of a plasma panel hard copy unit. AFHRL-TR-75-81, AD-A026 120. Lowry AFB, CO: Technical Training Division, December 1975. Project 1121. NTIS.** This report describes an investigation of a technique for producing paper copies of instructional computer terminal displays. Such a device appears to be a useful adjunct for the development of computer assisted instructional programs by authors. A digital device was simulated with a minicomputer; the techniques used to construct this device are described in this technical report. Examples of the hard copy produced and a description of the computer program used in the simulation are included in the report. (22 pp.)

539 **Foley, J.P., Jr. A proposed modified technical order system and its impact on maintenance, personnel and training. AFHRL-TR-75-82, AD-A022 252. Wright-Patterson AFB, OH: Advanced Systems Division, December 1975. Project 1710. NTIS.** This study represents an effort to synthesize the results of job performance aids and job-oriented training research together with promising potentials both proven and hypothesized. The categories of information and directions found in current maintenance technical orders (TO) are identified and classified. Their relationships to improved categories of data are indicated. The improved categories are found in fully proceduralized job performance aids (FPJPA) for non-troubleshooting (non-TS) and troubleshooting (TS) tasks, as well as in maintenance dependency chart (MDC) based aids for TS. Each category is considered in light of its unique contribution, or potential contribution, to improved maintenance when used by maintenance personnel with various levels of aptitudes, training and experience. The potential gains from the combining of FPJPA technology with job oriented training are discussed. Throughout the report, the fact is emphasized that both technologies are based on the systematic identification of maintenance tasks and the appropriate analyses of such tasks. Each category of data is, also, considered as to its utility for other users of TO categories; such as, supply and transportation specialists, operators, engineers, administrators, training specialists, and trainees. This systematic structuring of maintenance, TO, training, personnel and user factors resulted in a list of preferred TO categories which would improve maintenance but still meet the needs of other users. The preferred categories are: (1) FPJPA for non-TS tasks (job guide manuals), (2) FPJPA for TS tasks, (3) MDC with pictorial locators, (4) keyed schematics, (5) keyed information, (6) pictorials with locator grids, (7) aircraft wiring diagrams, (8) illustrated parts breakdowns (IPB), and (9) preservation, shipping and storage information. The state-of-the-art will support the immediate implementation of all of the categories except FPJPA for TS. They are now in advanced development and should soon be ready for implementation. The systematic considerations of this study provide the bases for recommendations concerning implementation of state-of-the-art job performance aids technology as well as for further research and development of other areas such as the coupling of FPJPA and job oriented training technologies. As with any work of this kind the projections, especially the hypotheses, reflect to some extent the experiences, insights, and biases of the author. (40 pp.)

540 **Stephenson, R.W., & Burkett, J.R. Analysis of the Air Force on-the-job training system. AFHRL-TR-75-83. Lowry AFB, CO: Technical Training Division, December 1975. Project 1121, Contract F41609-72-C-0036, American Institutes for Research. NTIS.** A system analysis of the Air Force OJT system was conducted. After many on-site visits and conferences and interviews with

hundreds of supervisors and trainees, 17 problem areas were identified. The nature of each problem area was defined by the reaction of work-center superintendents and OJT administrators to 75 specific suggestions for methods of improving the OJT program in the Air Force. Additional information about problem areas was obtained by analyzing survey data collected by the Air Force OJT Advisory Service in their 1973 survey of 1,592 OJT supervisors and 1,580 trainees, and by analyzing a small amount of questionnaire data collected by the authors. Thirty tentative conclusions were drawn. Specific recommendations for program changes were made, including recommendations for field tests and surveys to validate those conclusions that require additional information prior to wide-scale implementation. (116 pp.)

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Wright-Patterson AFB, Ohio 45433

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OCCUPATIONAL AND MANPOWER RESEARCH/OCCUPATIONAL RESEARCH DIVISION
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